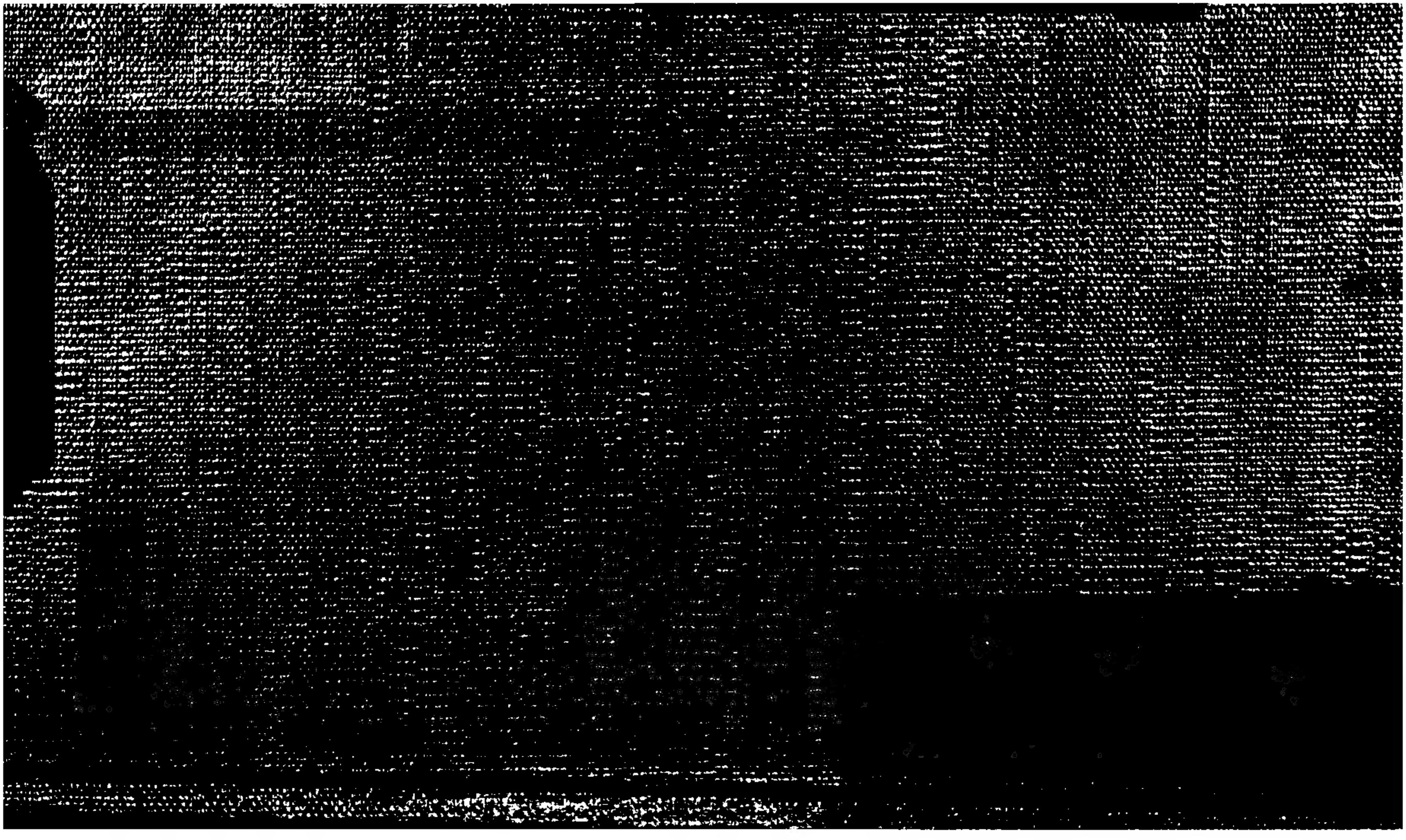

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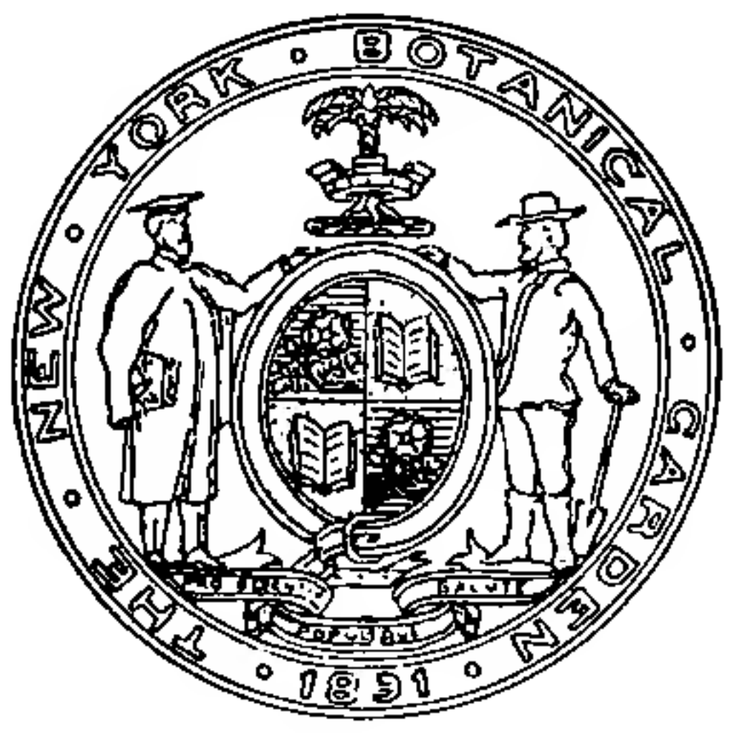

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A. B. STOUT

PLANTS OF THE GALAPAGOS ISLANDS
N. L. BRITTON

COCOA AND CHOCOLATE
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THE FLOWER MECHANISM OF AVOCADOS WITH REFERENCE TO POLLINATION AND THE PRODUCTION OF FRUIT[1]

(WITH FIGURE 1)

Avocado trees growing in California are decidedly irregular and uncertain in the yield of fruit. In extreme cases trees both in isolation and in orchard plantings produce little or no fruit year after year, while other trees of the same variety (propagated vegetatively and hence merely branches of the same parent tree) growing elsewhere may bear crops of fruit. These unproductive trees often grow vigorously and bloom profusely. Such unproductiveness frequently entails considerable financial loss to growers and in general has been somewhat of a handicap to the young industry of avocado-growing in California.

During the autumn of 1922 the sterility frequent for avocados attracted the interest of the writer and an investigation[2] covering several months was made which revealed that the development of the parts of the flower is such that self-, close- and certain cross-pollinations are chiefly prevented and are not to be depended upon for fruit production. A comparison of the flower behavior of different varieties, however, shows that the proper interplanting of certain varieties will greatly increase the chances

[1] Summary of a report presented at the Conference of Scientific Staff and Students of the New York Botanical Garden for November, 1923. For a more detailed account, see Ann. Rep. California Avocado Association 1922-23: 29-45. (Contrib. N. Y. Bot. Gard. No. 251.)

[2] This investigation was made during the winter and spring of 1922 23 at the request of the California Avocado Association and with the support of the authorities of Pomona College, where the writer spent the academic year as a visiting member of the faculty.

for proper pollination and thereby insure more abundant and more uniform yields of fruit.

The main points determined may be summarized as follows:—

1. In all varieties and seedling plants observed the flowers are all perfect with a pistil and stamens present and apparently fully developed in each. But each flower normally has two distinct and separate periods of opening. During the first period the pistil is ready for proper pollination and fertilization, but it is only during the second opening that the pollen is shed. The intervening period during which the flower is closed separates the time of maturity of the two kinds of sex organs in each flower most decidedly and in this particular is an advance over dichogamy (the maturity of the pistils and stamens of a flower at different times) as usually seen. In avocados self-fertilization in individual flowers is rarely possible.

2. The dichogamy is synchronous or periodic for a plant as a whole. The greater number of flowers on a tree of one variety open and close for each of the two periods in daily unison, so that during certain hours of each day all the flowers that are open are open for the first period while at other hours all flowers open are in the second period. This makes close-pollination (pollination from flower to flower on the same plant or on plants of the same clonal variety) for many flowers, at least, impossible. Cross-pollination between varieties is necessary for the proper pollination of many flowers and the subsequent setting of fruit, at least for most varieties.

3. The general survey made indicates that many, if not all, varieties of avocados may be grouped in two classes with respect to the relative alternation of the daily dichogamy. In one class, which may be designated as class *A*, the first-period flowers normally open during the forenoon and close about noon (to remain closed about 24 hours) and in the afternoon another set opens and these are opening for the second time. In the other group of varieties (class *B*) the second-period flowers normally open during the forenoon and first-period flowers are open during the afternoon. In this class the inter-period of closing normally covers about 36 hours.

The relative behavior of varieties is shown diagrammatically in the following chart. The particular records for this chart are for varieties in bloom in the same orchard and on the same

day, which was one of a series of warm, sunny, dry days on which the flower behavior may be considered as most nearly normal. This record is typical of the blooming behavior of avocados during such weather, as was determined by observations in numerous groves over a rather wide territory.

Chart 1

Hours of the Day

May 5, 1923	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.
A											
Blakeman	———	··	—	—	·	·					
Challenge	———	··	—	—	·	··					
Clower	———	·	·	—	—	·	·				
Colorado	———	·	—	—	·	·					
Dickinson	———	·	·	—	—	·	·				
Dicky	———	·	·	—	—	·	·				
El Oro	———	·	·	—	—	·	·				
Murrieta Green	———	·	·	—	—	·	·				
Mayapan	———	·	·	—	—	·	·				
Sharpless	———	·	·	—	—	·	·				
Spinks	———	··	—	—	—	·	·				
Taft	———	··	—	—	—	·	·				
B											
Fuerte	·	·	—	—	—	·	··	———			
Ganter	·	·	—	—	—	·	··	———			
Linda	·	·	—	—	—	·	·	———			
Lyon	·	·	—	—	—	·	··	———			
Montezuma	·	·	—	—	—	·	··	———			
Panchoy	·	·	·	—	—	·	··	———			
Queen	·	·	—	—	—	·	·	———			
Rey	·	·	—	—	—	·	·	———			
Walker	·	·	—	—	—	·	··	———			

In the above chart the continuous line indicates the hours when flowers were open for the first period. The dots and dashes indicate the hours when flowers were open for the second period, the pollen being shed most abundantly during the time indicated by the dashes. The chart clearly shows (a) that each variety normally has two different sets of flowers open during the day, (b) that each opens and closes in decided unison, (c) that the

two sets open alternately and (d) that the varieties fall into two contrasted groups with regard to the relative opening of the two sets of flowers.

4. It is clear that the relative time relations of the dichogamy determine whether cross-pollinations between two varieties are possible. There is slight chance and often no chance for cross-pollinations between two varieties of the same class throughout many days of their normal blooming. But a tree of class *A* and a tree of class *B* supplement each other in their dichogamy and afford the greatest chance for reciprocal cross-pollination.

5. The sequence and synchrony of the dichogamy is modified by weather conditions. Cool, cloudy, foggy or wet periods of weather affect the opening and closing of flowers and often throw the sequence of blooming out of stride, giving irregular opening, delayed opening and closing, and even a reversal of the daily alternation as seen on warm, sunny days. But varieties of the same class behave in much the same manner under similar weather conditions. This irregular or off-stride blooming frequently results in more or less overlapping of the two periods of bloom and apparently gives opportunity for close-pollinations. Certain varieties appear to be rather subject to such overlapping and in some this may be perhaps a normal condition. Thus the occasional setting of fruit to close-pollination by a single isolated tree or by trees of a solid planting of one variety may be expected. It is possible that a peculiar set of local weather conditions may sometimes favor setting of fruit year after year. But even in such cases there is no doubt that a proper interplanting will greatly increase the chances of many more proper pollinations and the production of larger and more uniform crops.

6. It seems certain that in California the honey bee is the principal agent effecting pollination of avocado flowers. When hives are near at hand bees are usually abundant visitors to the flowers. They visit both first- and second-period flowers for nectar and frequently they force their way into flowers that are closed after the first opening. But they may work busily and continuously on the flowers of a single tree or a group of trees of one variety throughout the entire sequence of bloom day after day for several weeks or months and yet effect few or even no proper pollinations. Bees will be most effective in promoting

pollination when they repeatedly fly back and forth from varieties that have flowers open for the second time to varieties which have flowers open for the first time. A *close* interplanting of varieties of class *A* with varieties of class *B* will afford greatest chance for such cross-visitations by bees. The grower who thus interplants and then provides bees in abundance will greatly increase the chances for the proper setting of fruit.

7. It is to be recognized that there may be certain further limitations to the relative effectiveness of interplantings. Differences in the quality and quantity of nectar produced by certain pairs of varieties may discourage or limit the cross-visitations of bees or other insects. There may be cross-incompatibilities in fertilization after proper cross-pollinations are made; that is, some pairs may cross-fertilize more readily than others. Variations from year to year in the calendar dates of flowering, in the amount of bloom, in any yearly alternate blooming or bearing, and in off-stride opening of flowers in response to weather conditions may all influence the value of the interplanting.

It should be noted that the only previous study of the flowers of avocados with reference to pollination and the setting of fruit appears to be that recently made by B. S. Nirody in Florida. The results of his observations were published in the Annual Report of the California Association for the year 1921–1922. Nirody found that the dichogamy is decidedly synchronous, that cross-pollination is necessary for the setting of much fruit, and that opportunity for crossing depends on the relative sequence of the dichogamy. The writer's observations in California confirm Nirody's observations in certain respects but extend and somewhat modify them in at least three main particulars.

(a) The maturity of the two sets of sex organs at two distinct periods of opening of flowers gives a more decided dichogamy than Nirody seems to have observed.

(b) The off-stride blooming to inclement weather gives greater variation in hours of blooming from day to day, and a less exact behavior according to a particular hour by the clock.

(c) The existence of two main groups of varieties makes the interplanting from the standpoint of affording chance for cross-pollination decidedly simpler than it would appear from Nirody's reports.

As far as is now known, in no other species is dichogamy so highly developed and specialized as in the avocado. Dichogamy of various grades and types is very common in plants. Often it is fully complete for individual flowers but there is constant overlapping on the plant of flowers in the two extreme conditions. In the avocado the daily periodicity is most decidedly complete and exclusive. Also, as far as now known, in other species the flower behavior of different seedlings is quite alike under the same conditions of light, temperature, and humidity. In the avocado the different seedlings fall into two groups, with one having its daily alternation exactly the reverse of that in the other, a condition which amply provides for cross-pollination.

Undoubtedly behavior similar to that of avocado flowers remains to be discovered in other species. In fact some observations made by Wester[1] suggest that in the Annonas and especially in the sugar apple (*Annona squamosa*) flower behavior may be like that in avocados. As the Annonas have been decidedly irregular in fruit production in Florida, more complete study should be made of the behavior of their flowers.

It is to be noted that the tendency in the growing of avocados commercially both in California and in Florida has been to grow few varieties and to plant these in solid blocks of one kind. It is to be recognized that a variety is propagated vegetatively by budding and grafting. Hence the tops of the thousands of trees of the Taft avocado are all branches derived from one seedling tree. The same is true of any other variety thus propagated. Thus the planting of one variety in solid blocks groups together plants with the same flowering habit, isolates them from other varieties and thereby reduces the chances for proper pollination. In such cases fruit-setting depends on the chances for close-pollination between the relatively few flowers that are overlapping (provided that these will really lead to the setting of fruit) and to such cross-pollinations as insects may effect from distant trees of other varieties.

The experiences of growers of avocados seem to indicate that some varieties are more or less self-fruitful at least under certain conditions. Possibly some varieties already exist or may be developed which under abundant insect visitations will be

[1] Wester, P. J. Pollination experiments with Annonas. Bulletin Torrey Botanical Club **37**: 529-539. 1910.

satisfactorily self-fruitful in commercial planting. But for the greatest success in avocado culture the difficulties due to insufficient pollination should be reduced to a minimum so that as far as they are concerned growers may be reasonably certain of maximum crops consistently year by year anywhere that avocados may be successfully grown. This can scarcely be expected from solid plantings of a single variety.

Apparently avocados have hitherto been planted with very little, if any, thought of any necessity for cross-pollination. The results condemn this procedure. Plantings of many varieties have often given scanty yields of fruit, particularly when there have been solid blocks of one sort. Certain varieties have been very generally discarded after being rather widely planted, chiefly because of unproductiveness. That this may be largely corrected by the proper interplanting of "A" with "B" varieties seems reasonably certain from the flower behavior. However, the most successful of such combinations must be determined by actual results in orchard practice over a considerable area and with best possible conditions for promoting insect pollination.

A. B. Stout,
Director of the Laboratories.

Explanation of Figure 1

The two photographs in this figure show how the normal behavior of avocado flowers limits the chances for proper pollination to certain cross-pollinations. Flowers numbered *1* are open for the first period; the pistils are ready to receive pollen but no pollen is being shed from the stamens of these flowers. Flowers numbered *2* are closed after the first opening: they will open again later. Flowers numbered *3* are open for the second time and are shedding pollen abundantly but the ends of the pistils are dead and black. Flowers numbered *4* have shed pollen and are either closing or are fully closed for the last time. This behavior prevents self-pollination of individual flowers.

Flowers of Fuerte normally open for the second time and shed pollen during the forenoon (I, *3*) and during the afternoon (IV, *1*) a set of flowers open for the first time. The daily sequence of the opening is exactly the reverse for Dickinson (II and V) and for Taft (III).

The synchrony decidedly limits chances for proper pollination between flowers of the same tree. Cross-pollination is also restricted except when a variety sheds pollen at a time when the flowers of another variety are open for the first time. Thus there is opportunity for abundant reciprocal cross-pollinations between Fuerte and Dickinson (I to II in forenoon, V to IV in afternoon) but not between Taft and Dickinson.

The studies made indicate that in regard to the daily sequence of the dichogamy under normal conditions all varieties and seedlings behave either as the Fuerte or as the Dickinson (See Chart I).

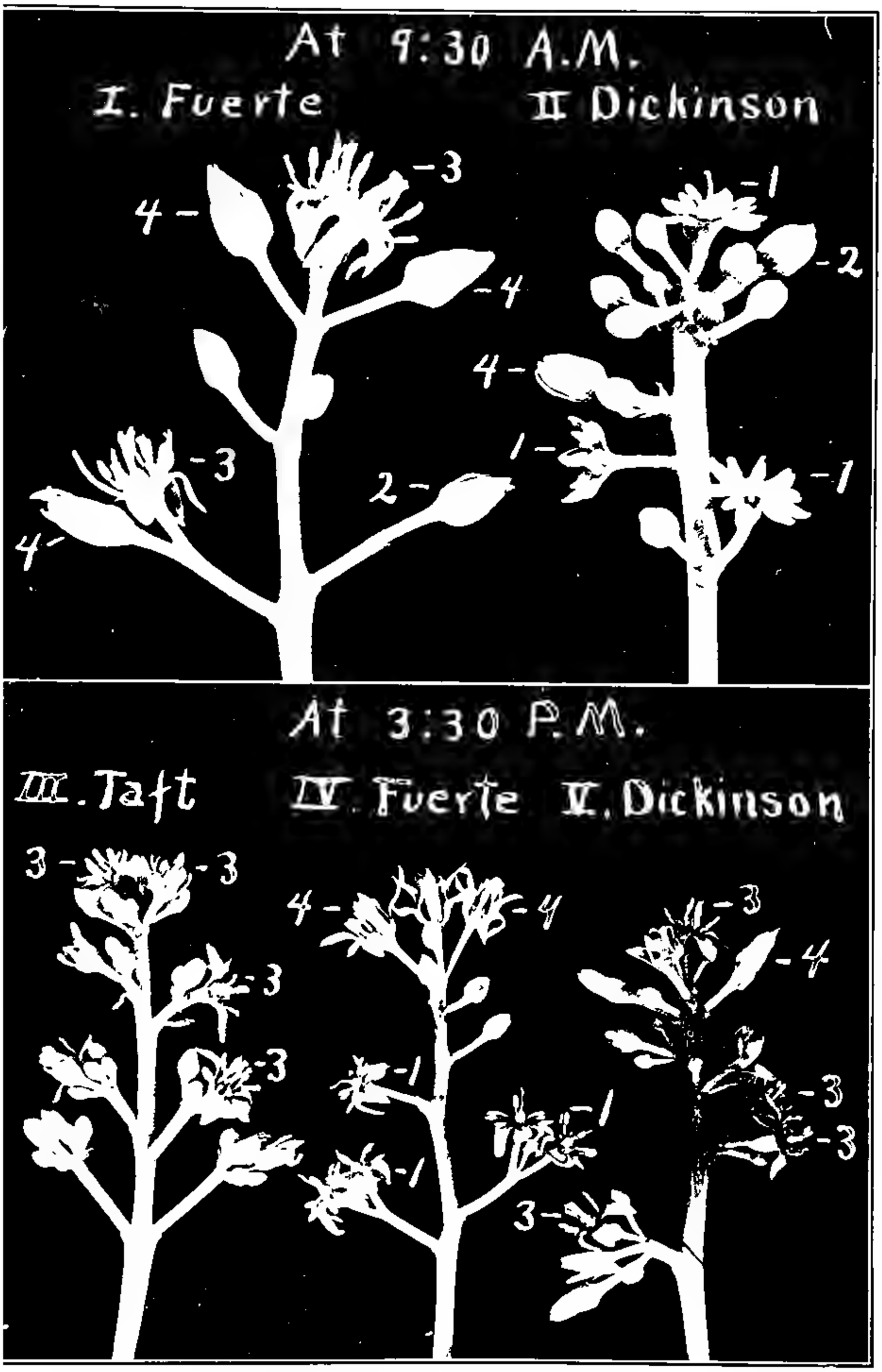

FIGURE 1. Photcgraphs showing condition of flowers of the avocado varieties uerte and Dickinson at 9:30 A.M., and of varieties Taft, Fuerte, and Dickinson : 3:30 P.M.

PLANTS OF THE GALAPAGOS ISLANDS

During the visit of the Williams Expedition of the New York Zoölogical Society to the Galapagos Islands in the spring of 1923 an interesting collection of herbarium specimens of plants was made by Professor W. M. Wheeler, Miss Ruth Rose, and Mr. William Beebe. This collection was transmitted to the New York Botanical Garden for study and forms a valuable addition to our scientific collections. The specimens are carefully prepared and in most cases well represent the species observed; duplicates have been deposited at the Gray Herbarium of Harvard University and at the United States National Museum at Washington, the institutions working in coöperation with us in the botanical exploration of northern South America, and their botanists have aided in the determination of some of the species, especially Dr. B. L. Robinson, of the Gray Herbarium, who made a critical study of the Galapagos vegetation some years ago, and Mrs. Agnes Chase, of the United States Bureau of Plant Industry, expert in grasses.

The flora of the archipelago has been made known through collections made by several scientific expeditions, commencing with those of Charles Darwin, in 1835, during the famous voyage of the "Beagle." The islands are situated nearly on the equator about 580 miles west of Ecuador; they are of volcanic origin, very rocky, with elevations recorded as reaching some 5000 feet. At a recent meeting of the Torrey Botanical Club held at the Garden, Mr. Beebe contributed a highly interesting account of them, and of their animals and plants, describing the extreme difficulty of traversing the land, owing to rough surfaces and the density of prickly and spiny vegetation, remarking that as yet no naturalist had succeeded in penetrating more than about five miles from the coast of any of the islands, or in reaching the higher elevations.

The latest estimate of the number of species and varieties of flowering plants inhabiting the Galapagos is that of Mr. Alban Stewart, botanist of the California Academy expedition of 1905–1906. This totals about 680, of which about 40 per cent are endemic, not growing anywhere else. It may well be that, whenever the high mountains are reached by explorers, additional species will be discovered. The Williams Expedition

added to the known flora *Mollugo Cerviana*, a widely distributed tropical small herb related to carpet-weed; a fleshy, yellow-flowered plant, perhaps a species of *Portulaca*, which has been brought under cultivation for further observation in one of our greenhouses; and a smut-fungus of the genus *Sorosporium* parasitic on the bur-grass, *Cenchrus platystachys*. A silvery-leaved species of *Atriplex*, collected with foliage only, can not be specifically identified without knowing its fruit.

Cordia lutea, a small tree, with bright yellow flowers in clusters, observed on several islands, would form a fine addition to tropical gardens if it could be brought under cultivation; it might be grown from seed. The bushy *Lantana peduncularis*, one of the endemic species, might also be attractive horticulturally.

N. L. BRITTON.

COCOA AND CHOCOLATE[1]

Cocoa must not be confused in any sense with the cocoanut, the valuable fruit of a large palm abundantly planted in the Tropics; nor with coca, a small shrub found on the western coast of South America, the leaves of which yield cocaine. The tree from which cocoa and chocolate are obtained grew wild in Central America and South America and was cultivated in Mexico and Peru long before the coming of Columbus. It is a small tree with evergreen leaves, wax-like flowers, and melon-shaped fruits containing from twenty to forty almond-shaped seeds, or beans, which are light-colored when fresh but change to reddish-brown after curing.

Several of these trees may be seen in House 4, Conservatory Range 1, at the New York Botanical Garden, and there is an exhibit of the fruits and seeds on the main floor of the Museum. The cocoa beans of commerce are obtained from immense plantations in Trinidad, Ecuador, Brazil, and elsewhere, the mature fruits being cut from the trees twice a year with knives attached to long poles and piled in heaps on the ground. The seeds are then removed and put through a fermenting process which

[1] Abstract of a lecture given in the Central Display Greenhouse of Conservatory Range 2 on Saturday afternoon, December 29, 1923.

greatly improves their flavor, after which they are dried in the sun and sent to market.

The chocolate tree was held in high esteem by the Aztecs, who believed that their God of the Air, Quetzalcoatl, corresponding to Jupiter, brought the seed to earth and showed their ancestors how to grow them. The beans were used as money, while the wood of the tree was used to kindle fire by rubbing two dried pieces of it together. A slave could be bought for one hundred beans;—and Montezuma's wealth consisted largely of immense stores of these precious seeds.

Not only are there several distinct varieties of the common chocolate tree, such as "Criollo," "Forastero," "Calabacillo," etc., but there are other *species* of chocolate trees in cultivation. Probably the best cocoa in Mexico is obtained from the narrow-leaved species, *Theobroma angustifolia*, grown in Chiapas; while *Theobroma pentagona*, so named because of its large five-ribbed fruits, is even more widely known and cultivated in Nicaragua and several other cocoa-producing regions.

Cocoa is grown in rich, moist, hot lowlands, the trees being planted about twelve feet apart. They are usually shaded by other trees planted near, but where rains are frequent, shading has been found unnecessary and the practice is being discontinued. Seedling trees have been generally used, making the crop variable and uncertain, but grafting has now been found practicable.

All parts of the cocoa tree are subject to pests. Cankers attack the roots and trunk, borers and other insects mutilate the wood and bark, and the fruits decay from various causes, especially when injured by rats, squirrels, or birds. Hurricanes strip the trees readily because the fruits are heavy and attached by slender stems.

The trees begin to bear when four years old and yield crops for thirty years or more. There is no stated season when the fruits ripen, but it is customary to harvest the crop twice a year, in midwinter and midsummer. In Venezuela, December and June are the best months.

The Spanish invaders under Cortez in 1519 found chocolate in common use among the Mexicans both as a confection and as a beverage. In preparing the latter, the beans were roasted, crushed on a flat stone, flavored with spices, and boiled for some time in water, the liquid meanwhile being beaten into a foam.

The Mexican name "chocolatl," or "cacahuatl," which probably referred to the sound made in the beating, was abbreviated by the Spaniards to "cacao" and later changed by the English to "cocoa." Bernal Diaz, a Spanish officer, is credited with having seen Montezuma drinking chocolate from a golden cup, and this famous Aztec king is said to have had fifty jars of this delicious beverage for his daily consumption.

The process of making chocolate was long kept a secret in Portugal and Spain, where the new Mexican drink was introduced by Fernando Cortez in 1529, and exorbitant prices were charged for it. It was carried into Italy by Cerletti in 1606 and into England about fifty years later, where it remained for a long time among the luxuries of the wealthy, even after the use of tea and coffee had become common. The first chocolate factory was established in the United States about 1770, the crude cocoa being brought in by Massachusetts traders in exchange for fish and other articles shipped to the West Indies and Central America.

On arrival at the factory, the crude cocoa beans of commerce are first carefully roasted to bring out their best flavor; then cracked and fanned to remove the thin shell which surrounds each individual bean; and finally blended, ground, and molded into cakes of bitter chocolate. In making other forms of chocolate, sugar, milk powder, spices, nuts, etc., are mixed with the plain melted chocolate and molded into the shapes desired.

Breakfast cocoa is simply the powdered cocoa bean from which some of the oil or fat has been removed, the powder being bolted through very fine silk screens and put up in cans for the market. Pure cocoa should have the rich, reddish color known to artists as "cacao-red." It usually shrinks somewhat in bulk after boxing. The fat, known as "cocoa butter," is used in chocolate creams and other candies, as well as in the manufacture of cosmetics and toilet preparations. It will melt at the temperature of the body and retains its purity and sweetness indefinitely.

Both chocolate and cocoa are highly nutritious and palatable in all their forms and they are more abundantly used today by the people of the United States than by the inhabitants of any other country. Three hundred million pounds of crude cocoa were imported into the United States in 1921 and a large quantity of the finished products were exported. It is an interesting

fact that chocolate was the first beverage to attract general attention in Europe and it is well known that chocolate and cocoa are far superior to both tea and coffee because they are nutritious and only mildly stimulating. A cup of cocoa served in the usual way with sugar and cream furnishes nearly three hundred calories of energy, in the form of fat, protein, starch, and sugar. Chocolate contains more fat and is therefore less easily digested by some stomachs. Theobromine, a drug similar to caffein, is present in small amounts but not sufficiently abundant to cause any injury. Cocoa is an ideal drink for children during wintry weather; and it is eminently fitting that a huge fortune acquired through the sale of cocoa and chocolate should have been recently returned to the children for their education.

W. A. MURRILL.

THE ANCESTRAL HISTORY OF SOME EXISTING PLANTS[1]

The existing vegetation of the Earth is not identical with that of the past, any more than the existing animal life is the same as that of the past; and the farther back we extend our investigations the greater and greater the differences between the existing and the extinct vegetation are found to be.

The individual plant or animal changes in appearance from day to day, as it evolves from infancy to old age. The species or the genus to which an individual belongs also changes, from generation to generation. Individuals die and disappear. Species, genera, and even entire orders of plants have passed through their cycles of infancy, maximum development, and senescence. Some have disappeared and left no records behind them. Remains of others have been preserved as fossils; and it is from these remains that we are able to trace the ancestry of many of the species of plants now in existence.

The early stages in the development of an individual plant often give an insight or suggestion in regard to the evolution of the species or genus to which the individual belongs. If, for example, the first leaves that appear on a young seedling tree or sapling

[1] Abstract of a lecture given at The New York Botanical Garden on Saturday, October 6, 1923.

are entire, and the later ones are more or less irregular or notched, the natural inference is that the original ancestor of the species to which the tree belongs had entire leaves, and that the species with irregular or notched leaves was evolved subsequently. Abnormalities in growth or structure also frequently afford ancestral clues, as such abnormalities often represent atavism or reversion to ancestral characters. A monotypic genus one that is represented by a single species, as for example the Ginkgo or Maiden-hair tree; and others that are represented by but two or three species, as Liriodendron or Tulip tree, Sequoia, etc.—may generally be recognized as types of vegetation that have passed their maximum of development and are now on the verge of extinction. They were important elements in the former vegetation of the Earth, but are now out of place in their environment and out of touch with their neighbors.

The Ginkgo tree, native only in eastern Asia, and the sole survivor of the genus to which it belongs, was formerly one of a numerous family of genera and species that were world wide in their distribution. The genus Liriodendron, represented only by the common Tulip tree of eastern North America and a variety that occurs in China, has a similar history. The two species of Sequoia or giant redwoods of California, now restricted in their distribution to scattered groves, were formerly, with other species of the genus, dominant elements in a flora that covered the Earth from pole to pole.

The lecture was illustrated with colored lantern slides of a number of our well known trees, such as Sassafras, Sweet Gum, Sycamore, Basswood or Tulip tree, Bald Cypress, Sequoia, etc., and others showing the fossil remains of their ancestors, and a diagram that indicated the geological ages and periods in which the plants represented by the fossils had their beginnings and their times of maximum development.

ARTHUR HOLLICK.

AN EXTRAORDINARY DECEMBER

With the ground scarcely frozen at any time, the ponds with only fugitive films of ice, and with two or three flurries of snow, which melted immediately; with a succession of balmy southerly winds and warm rains, and an average temperature well above

the normal, December of 1923 passes into history as a most interesting, remarkable, and enjoyable month, with widespread content as regards the saving of fuel and getting autumn farm work done.

The reaction of the unseasonable warm weather on vegetation at The New York Botanical Garden has been noteworthy. Buds of many trees and shrubs have swollen as much as they ordinarily do in early spring; the European hazel (*Corylus pontica*) has gone further by maturing its flowers; a bush in a protected warm situation in the border-screen along the railroad north of the Elevated Railway Station was observed on December 27th festooned with its graceful drooping cream-colored catkins about three inches long, profusely shedding the yellow pollen, and another bush, well exposed, in the Fruticetum north of the Water Garden was nearly as far advanced. Farther north in the Fruticetum in the witch-hazel collection, one bush of the Japanese witch-hazel (*Hamamelis japonica*) was nearly in full flower at the same date and some of the bright yellow flowers were in evidence on other bushes among the dry persistent leaves of the past season, all most attractive and interesting; the Missouri witch-hazel (*Hamamelis vernalis*) also had some open flowers. Both these shrubs usually bloom in late February or March, differing from our familiar *Hamamelis virginiana*, which blooms in October and November and is now bare of both flowers and leaves.

Garden work has been extended into the winter; a large collection of climbing roses, given by Bobbink and Atkins, was planted during December, some of it as late as December 27th; and Dr. Southwick has kept on planting in the rock-garden. Some tulips have poked their noses above ground.

N. L. Britton.

DECEMBER BLOOM IN THE ROCK GARDEN

It is of interest to note the second blooming of a number of plants in the Rock Garden. The unusual mild autumn of this year forced many into a new growth as well as a second flowering. But for the sudden change in temperature on the 14th of December, many that had well-developed buds would have bloomed also.

Phlox subulata bloomed quite vigorously and many of the Aubrietias presented quite a show. Among those most profuse in bloom were *A. olympica*, *A. Columnae*, and *A. Auricula*, which were the most pronounced. *A. deltoidea*, which we would naturally expect to advance also, did not show any sign of late growth.

Erodium cicutarium bloomed freely and no doubt it also will make a valuable late bloomer.

A number of clumps of Bluets, *Houstonia caerulea*, produced from seven to nine fine flowers and *Viola pedata* kept up its autumn record, it having bloomed nearly all summer, the change of soil and environment seeming to induce profuse flowering.

Viola tricolor was also much in evidence. The vigorous plants from self-sown spring seed were still in bloom on December 20th.

A species of *Potentilla* (species not determined) with white flowers, gave a profusion of autumn blooms and may perhaps be relied on to add to the autumn glory of the Rock Garden.

The species of *Aubrietia*, *Arabis*, and *Cerastium* all made additional growth which, if not destroyed by severe cold, will add much to the wealth of bloom in early spring.

EDMUND B. SOUTHWICK.

A TRIP TO ECUADOR[1]

Doctor Frank M. Chapman, for the past ten years, has been conducting, on behalf of the American Museum, field researches throughout the Andes of South America to determine the origin of bird life. His lecture at the Botanical Garden dealt with his recent explorations in Ecuador, which country, in company with Mr. George K. Cherrie, he visited in the summer of 1922.

Ecuador is stated to be richer in bird life than any other country of equal extent in the world. Approximately 1600 species of birds have been recorded from it, or about one-third the bird life of South America and one-tenth the bird life of the world. The wealth of the avifauna is due not only to the diversity of the country at sea level, but more particularly to the development of life zones in the Andes from sea level to snow line. In

[1] Abstract of a lecture delivered by Dr. Frank M. Chapman, Curator of Birds in the American Museum of Natural History, on Saturday afternoon, November 24, 1923, at the Museum of The New York Botanical Garden.

addition to the Tropical or basal Zone, there exist Subtropical, Temperate, and Paramo Zones, each one of which has species peculiar to itself. A journey, therefore, from sea level to snow line, in a measure epitomizes one from the Equator to the Pole. Among the interesting discoveries by Dr. Chapman and his associates, was the presence on the coast of Ecuador in mid-July of large numbers of North American shore birds, curlews, plovers, etc., whose breeding grounds are north of the Arctic Circle. It was found on dissection that these were barren, non-breeding birds, and the fact that they continued to remain in Ecuador long after their associates had migrated to the north, is evidence in support of the theory that migration from winter to summer quarters is prompted primarily by the desire to find a nesting ground. The lecture was illustrated by eighty colored slides, showing every type of country from sea level to the upper limit of life at about 14,500 feet.

THE JOSEPH LEIDY COMMEMORATIVE MEETING

Dr. Arthur Hollick, as delegate representing The New York Botanical Garden, the Botanical Society of America, and the Torrey Botanical Club, attended the Joseph Leidy Commemorative Meeting, held in Philadelphia December 6th.

The meeting was in commemoration of the centenary of the birth of Joseph Leidy, physician and naturalist, whose scientific activities were most closely connected with institutions in and near to Philadelphia. The arrangements were under the immediate auspices of the Academy of Natural Sciences and the College of Physicians, of Philadelphia, and the University of Pennsylvania, with other institutions and societies participating. About five nundred delegates were in attendance, representing institutions from all parts of the world.

Addresses upon Doctor Leidy's work in medicine, zoölogy, paleontology, botany, geology, and mineralogy, and upon his influence on general scientific thought and development, were presented by those who were best qualified to speak on these subjects.

At one of the sessions announcement was made of the Leidy Medal Foundation, the gift of Joseph Leidy, a nephew. It is

to consist of a gold medal and cash honorarium, to be awarded every three years for conspicuous achievement in the advancement of biological science.

Although best known for his work in vertebrate paleontology, Doctor Leidy was a typical naturalist of the old school, who was interested in all branches of natural science. He was an enthusiastic botanist, but he published very little on the subject—mostly in the form of notes, in the publications of the Academy of Natural Sciences of Philadelphia. He collected the local flora quite extensively and assisted in the compilation of the local flora catalogue. He was particularly interested in the problem of the botanical status of the Bartram Oak (*Quercus heterophylla* Michx.), and it is interesting to note that he was one of those who contended for its probable hybrid origin, as shown in a note recorded on page 415 of the Proceedings of the Academy for 1875: "Prof. Leidy exhibited a branch of *Quercus heterophylla* which he had obtained from a large tree, growing on the farm of Mr. J. I. Bishop, in Burlington County, New Jersey. The foliage, he thought, indicated a hybrid between *Q. Phellos* and *Q. palustris*. He recommended the introduction of this rare hybrid oak into our city park."

CONFERENCE NOTES FOR DECEMBER[1]

At the Conference of the Scientific Staff and Registered Students of The New York Botanical Garden held in the Museum Building on Wednesday, December 5th, Dr. H. A. Gleason presented a paper on "Some Statistical Studies on the Structure of the Plant Association," with special reference to the relation between the number of species and the size of the area, based on his research during the summer of 1923 at the Biological Station of the University of Michigan.

It is of course almost axiomatic that larger areas contain more species than smaller ones, but these researches show that, within the limits of a single association, the increase in species from a small area to a larger one may be expressed by an equation, and that by means of this equation the number of species in an

[1] For abstract of paper given at the conference for November, see page 1 of the present issue.

association, or any part of one, may be predicted with a high degree of accuracy. The rate of increase depends on various ecological conditions and can be determined only by observation, but, once determined, it is found to be constant for areas of all sizes as long as they are expressed by their logarithm rather than directly. Prediction of the number of species on tracts ranging in size from two to eleven acres, based on direct observations on unit areas of only one fortieth of an acre, were found to have an average error of less than two per cent. His paper will be published in full in "Ecology."

PUBLIC LECTURES DURING JANUARY AND FEBRUARY

The following is the program of lectures in the Central Display Greenhouse, Conservatory Range 2, on Saturday afternoon (3 P. M.) during the two midwinter months:

Jan. 5. "Greenhouse Pests." Dr. F. J. Seaver
Jan. 12. "Rubber Plants." Dr. A. B. Stout
Jan. 19. "Orchids." Dr. H. A. Gleason
Jan. 26. "Begonias and Other House Plants."
Mr. K. R. Boynton
Mr. H. W. Becker
Feb. 2. "Starch-bearing Plants." Dr. M. A. Howe
Feb. 9. "Palms." Dr. J. K. Small
Feb. 16. "Cinerarias and Primulas." Mr. K. R. Boynton
Mr. Edward Doherty
Feb. 23. "Ferns." Dr. H. A. Gleason

NOTES, NEWS AND COMMENT

A large specimen plant of *Agave attenuata* is blooming in Conservatory Range 1. A companion plant attracted much attention last winter, and the present flower stalk gives promise of producing as many blooms as that did.

Young plants of the Paraguay Tea (*Ilex paraguariensis*) have been received from the Bureau of Plant Industry at Washington. These were grown, Mr. David Bissett says, from seed collected in the territory of Misiones, Argentina.

In order to accommodate the continuously increasing collections of books and herbarium material, the library equipment has been increased by three steel stacks with 700 lineal feet of book shelving, and twelve cases have been installed in the herbarium.

Dr. Ralph R. Stewart of Gordon College, Rawalpindi, British India, is again at the Garden engaged in working over his collections from the Northwest Himalaya and the Punjab. Most of his material is from the mountains of Kashmir. He expects to return to India next summer.

About 100 young women of the Walton School visited the Garden during December to study ferns and orchids. Their attention was devoted chiefly to the large collections of living plants in these two groups at Conservatory Range 2, but they also examined the fossil ferns in the basement of the Museum Building and the exhibit of local species on the second floor.

The largest of the several Kadsura (*Cercidophyllum japonicum*) trees in the Arboretum fruited freely this year. The fruit capsules are of three or four cells which split from each other when ripe, and are well filled with seeds. The large tree near the Elevated Approach is a staminate tree. They bloom in early spring. The flowers are not showy, consisting mainly of the stamens, but they are numerous.

Meteorology for November. The total precipitation for the month was 3.47 inches. The maximum temperatures recorded for each week were *68.5° on the 5th*, 59.5° on the 14th, 61° on the 22nd and 59° on the 30th. The minimum temperatures were *26° on the 2nd and on the 9th*, 36° on the 13th, 29° on the 19th and *26° on the 29th*. The first hard killing frost of the autumn was on the morning of the 2nd.

The following visiting botanists have registered in the library during the autumn:

Mr. C. W Johnson, Springfield, Mass.; Mr. C. A. Weatherby, East Hartford, Conn.; Prof. G. E. Nichols, New Haven, Conn.; Prof. Caroline A. Black, New London, Conn.; Prof. H. M. Fitzpatrick, Ithaca, N. Y.; Mr. Calvin C. Laney, Rochester, N. Y.; Messrs. F. E. Gladwin, H. B. Tukey and G. L. Slate, Geneva, N. Y.; Prof. Charles S. Boyer, Philadelphia, Pa.; Mr. Harold W. Pretz, Allentown, Pa.; Messrs. Wilson Popenoe, C. G. Martin, E. P. Killip and W. W. Eggleston, Washington, D. C.; Prof.

W. C. Coker, Chapel Hill, N. C.; Dr. E. N. Transeau, Columbus Ohio; Mr. C. J. Humphrey, Madison, Wis.; Prof. G. W. Martin, Iowa City, Iowa; Prof. Douglas H. Campbell, Stanford University, Cal.; Prof. H. W. Smith, Truro, N. S.; and Grace G. Gilchrist, Bristol, Eng.

Mr. Frederick H. Horsford of Charlotte, Vermont, founder and owner of the Horsford Nurseries, died on November 4, 1923, in his sixty-ninth year. Before establishing his nurseries, in 1893, he was associated for many years with the late Cyrus G. Pringle, famous for botanical explorations of Mexico, in collecting and preparing sets of specimens for the leading herbaria of Europe and America. Later he gave considerable attentiou to hybridizing cultivated plants and he is credited with originating several varieties of peas, oats, and barley. In his nurseries he specialized in plants that resist the rigors of the northern New England winter. Some of the hardy lilies and other plants cultivated in The New York Botanical Garden came from his establishment.

Several times during the autumn, in and near Bronx Park, attention has been directed to the cottony or snowy masses on the trunks of trees in the crevices of the bark or crotches of the lower branches. These masses consist of insect eggs which have been deposited in a cottony matrix, apparently those of the mealy bug, since living specimens were found on the few leaves still remaining on the tree. The mealy bug is one of the unarmored scale insects, i. e., one in which the female is not fixed and covered with a scale as in the true or armored scale insects. The female of the mealy bug is white and covered with a powdery substance which suggests the name. They are free and move about, although rather sluggishly, sucking the juices from the plant on which they occur. Each female deposits several hundred eggs, the number varying with the species, and it is apparently these egg masses which have attracted the attention of a number of visitors about the grounds during the autumn. *F. J. Seaver.*

Dr. W. A. Murrill sailed for Buenos Aires, January 12, on the S. S. "Van Dyck," of the Lamport and Holt Line. He expects to visit the botanists in Argentina and secure as many botanical specimens as possible for the Garden herbarium. Professor Carlos Spegazzini, of La Plata, has a large collection of South

American fungi, including hundreds of types, which is of the greatest interest to students of mycology. There is also a collection of fungi at the Museum of Natural History in Buenos Aires. On the return journey, he will make a stop at Rio de Janeiro, where he will not only examine herbarium material but also do considerable collecting in and near this splendid city. A large percentage of the earlier types of South American fungi were collected in Brazil and taken to Kew Gardens in England, where they were described by Berkeley. The three Guianas also furnished a number of types, which were described by English, French, and Dutch botanists. Leaving the boat at Trinidad, Dr. Murrill will cross over to British Guiana and spend as much time as possible in the great forests near the coast and along the rivers. He is planning to return to New York in April.

Many strange objects come to museums, either for identification or for verification of the finder's conviction or idea of what they are or ought to be. A large number of such objects that are referred to the paleobotanist for determination are concretions, which may simulate almost any object, organic or inorganic. A concretion consists of an inner part—a nucleus of some kind—around which is deposited layer upon layer of the mineral substance that forms the exterior part. If the nucleus is symmetrical in form—a rounded grain of sand for example—the resulting concretion is usually more or less spheroidal in shape. If the nucleus is longer than broad—such as a fragment of a root or twig—the concretion assumes an elongated form. A nucleus of irregular shape may give rise to a concretion of erratic and often startling appearance. Concretions usually occur in connection with clay deposits and they are commonly known as "clay dogs." Occasionally certain specimens are identified by the finders as fossil fruit of one kind or another, and it is usually difficult, and sometimes impossible, to convince them that they are mistaken. A fossil "apple" and a fossil "banana" were recently transmitted to the Museum for identification, and they are probably still so regarded, despite the carefully worded explanatory reports on their concretionary nature.—*Arthur Hollick.*

Collections recently received by the Botanical Garden in exchange with the Museum of Paris are being added to the herba-

rium. Among them are numerous plants from French Guiana, collected by Sagot, Melinon, Le Prieur, and others, which are proving to be of great value in the investigation of the flora of that country.

Dr. H. A. Gleason represented the Botanical Garden at the recent meeting of the American Association for the Advancement of Science and its affiliated societies in Cincinnati. He presented a paper before the Ecological Society on "The relation between Species and Area," and participated in the symposium on "Age and Area" conducted by the Systematic Section of the Botanical Society of America.

The Garden Magazine, in its December number, devoted a page to a most timely topic, under the heading of "Long Life To Our Christmas Greens" by Elizabeth G. Britton. It is stated that the National Garden Association, with its eight affiliated organizations, the Garden Club of America, the New England Society for the Preservation of Native Plants, and the Wild Flower Preservation Society are now crusading for the cause of Christmas greens. The kinds most in danger of extermination are *holly*, *laurel*, and *ground pine*, all of which are used in large quantities, and mostly from wild sources. Tubbed and potted plants and artificial wreaths for home decorations are recommended. Particularly available is the *Poinsettia*, which may be had from the ten-cent stores and the florists. The following advice is given:

Increase the Pleasure of Holiday Time for the Gardener by the Use of Living Trees.

Grow Holly and Other Festal Greenery on the Home Grounds to be Enjoyed the Year Through

Get Nursery-grown Evergreens for Later Planting Out.

Don't buy Winterberry.

Don't buy Holly Wreaths.

Don't buy Spruce Trees for Christmas.

Don't buy Ropes of Laurel or Ground Pine.

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THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

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THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

VOL. XXV FEBRUARY, 1924 No. 290

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OF

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CALYPSO BULBOSA

JOURNAL
OF
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CALYPSO

(WITH PLATES 283 AND 284)

"See! Where that thoughtless wind the leaves is lifting,
Above her mossy bed
On lightest tiptoe poised, Calypso hovers,
Her rosy wings outspread."

It is Homer, is it not, who in his "Odyssey" tells us that Atlas was the father of Calypso, the beautiful queen of the mythical island of Ogygia, said to have been invisible to navigators? She it was, who, through her powers of fascination, prevailed upon Ulysses, after he had been shipwrecked upon her shores (when returning from the capture of Troy), to remain with her seven years, during which time she entertained the hero with great hospitality, and on his final departure is said to have died of grief.

After this goddess the above little orchid is named, and rightly so, for the charms of the plant to an orchid enthusiast are irresistible. Linnaeus, when he first found it in Sweden, took it as belonging to the Cypripediums, owing to its shoe-like labellum, and gave it the name of *Cypripedium boreale*, but its real relationship is with *Coelogyne*, a genus inhabiting the East Indies. It is a monotypic genus, ranging in the cooler portions of the North Temperate Zone, in Europe, Asia, and North America, being found in Sweden, Lapland, and Russia, while in North America it occurs as far south as California, Arizona, and New Mexico on the west, and northern New England on the east, but only in very restricted areas, its true home being in the north, from Oregon to Alaska, and north-eastward across the continent to Labrador. In the Rockies, it is said to grow at heights of 4000 to 5000 feet above sea-level, and there a form has also been

described as having a beard of white, instead of yellow, hairs, at the point of the division of the labellum. At Hatley, in Quebec, I find it in deep cedar woods, at an elevation of about 1000 feet above sea-level, literally poised (as described in the opening verse to this paper), for it hardly seems to be growing in its mossy bed, so easily can it be lifted therefrom. There is really only one good station for it, the other two (which were discovered only this season, 1923) being very small ones, and containing not more than half a dozen plants or so in each. In its mossy cool retreats, the following plants are found more or less associated with it, viz.: Dwarf Cornel (*Cornus canadensis*), White Violet (*Viola pallens*), Gold-thread (*Coptis trifolia*), Creeping Snowberry (*Chiogenes hispidula*), Twin-flower (*Linnaea borealis* var. *americana*), Wild Strawberry (*Fragaria virginiana*), Creeping Dalibarda (*Dalibarda repens*), One-flowered Pyrola (*Moneses uniflora*), Dwarf Raspberry (*Rubus triflorus*), Mitrewort (*Mitella nuda*), American Fly Honeysuckle (*Lonicera canadensis*), Common Wood Sorrel (*Oxalis Acetosella*), Wild Sarsaparilla (*Aralia nudicaulis*), Star Flower (*Trientalis americana*), Jack-in-the-Pulpit (*Arisaema triphyllum*), Oak Fern (*Thelypteris Dryopteris*), Painted Trillium (*Trillium undulatum*), and the Small Northern Bog Orchis (*Habenaria obtusata*).

It was on May 15, 1918, while following up an equally rare warbler, the Cape May (*Dendroica tigrina*), that I first discovered this little northern gem, which at that date was in the pink of condition, only ten plants, however, being located. Since then, I have counted as many as fifty plants in a season, more especially in 1921, which was a most prolific year, the flowers being fully out on May 7. This, however, is an exceptionally early date, the average one for the past six years being May 18, which nevertheless gives Calypso a good lead over its rivals, the Showy Orchis (*Orchis spectabilis*) and the Pink Lady's Slipper or Moccasin Flower (*Cypripedium acaule*), for the honour of being the earliest bloomer in these parts. Baldwin in his "Orchids of New England," 1884, speaks of May 20 as being an exceptionally early date for the appearance of Calypso in Southern Vermont, the first week in June being in his opinion more about the average time. This of course differs with my experience at Hatley, and seems somewhat strange, as one would naturally expect the more southern range to produce flowers at an earlier date than

here. The latest record I have for a flower in bloom is June 18, 1923, and this was a cold backward season. In 1920, the plants were in fruit on June 22, or rather I should say two plants were, for the seeds of Calypso very seldom develop and ripen, propagation taking place by means of new tubers, which are formed each year, generally at the base of the old tuber, without which secondary aid the species would very soon become extinct. The blooms are sweet-scented, a fact which very few of our text books mention. They are described in Gray's Manual, 7th edition, as follows:

Sepals and petals similar, ascending, spreading, oblong-lanceolate, acute, magenta crimson, rarely white. Lip larger than the rest of the flower, saccate, with three longitudinal rows of yellow (or white) glass-like hairs in front, and with a translucent apron-like appendage (formed by the overlapping of the lip) spotted with madder-purple, the sac (bearing two conspicuous horns at its base) whitish, with irregular purple-madder markings. Column winged, having the operculate anther just below the apex; pollen-masses waxy, 2, each 2-parted, all sessile on a square gland. Leaf solitary. Scape one-flowered.

Most of these points, with the exception of the column, are clearly brought out in the flower depicted on PLATE No. 283. Only once in the past six years have I come across a white bloom, and once, a flesh-coloured one, both of these, curiously enough, being found on the same date, May 25, 1920. Mr. Olof O. Nylander of Caribou, Maine, records in his "The Orchis of Aroostook," 1918, having found a plant in the spring of 1908, with two flowers on the stem, this, which is still in his possession, probably being the only double-flowered specimen on record.

On three occasions only have I found plants exceeding 16 cm. in height, the tallest being 18.50 cm., which exceeds the extreme given in Gray's Manual by just half a centimeter. The average height of twenty-four measured plants comes out as 10.60 cm. As regards the leaves, they are usually small, my finest example measuring 6 cm. in length by 4 cm. in width.

As already mentioned, I first discovered the species in 1918, but it was not until the autumn of 1922 that I began thoroughly to study the underground development of our native orchids, in view of the paucity of our knowledge on the subject. In the present species for instance, how many even know of, or have

ever seen the coralloid rhizomes, that may sometimes be found attached to the tubers? Most of our text books, even including Gray's Manual, say nothing whatever about the matter. However, with the aid of the accompanying plates, I hope to be able to trace the whole underground development of the species.

Taking PLATE No. 283 to begin with, all the plants there depicted, with the exception of the one in the top right-hand corner, were found growing together in a bunch, on the top of a fallen cedar tree, on May 27, 1923. In all of these a coralloid palmate body may be seen accompanying the tubers. Irmisch "Beiträge zur Biologie und Morphologie der Orchideen," Leipzig, 1853, has described the tuber, and calls attention to the fact that the tuber consists of two internodes, or sometimes of only one, below the leaf, and that the leaf develops some time before the flower appears. He also cites a description given by Liboschitz and Trinius "Flore des environs de St. Pétersbourg et de Moscou," 1818, p. 214, in which mention is made of a coralloid palmate body sometimes accompanying the tuber. It has generally been supposed, I believe, that these coralloid rhizomes are found only on very young vegetative plants, and that they disappear as the individuals become mature. This is by no means the case, as can be seen in the central figure of our plate, of a mature plant in bloom. Another point of interest attached to this specimen, is the fact, that when first found, some ten days or so previous to the above date (May 25), there were two apparently healthy flowering stalks, one on the right-hand side of the tuber, the other in the centre of the leaf. The first-named developed and bore a flower, as can be seen, while the other, from some unknown cause, withered and died away, the shrivelled up remains still being visible in the centre of the leaf. It may be well perhaps to mention that one is far more likely to find these coralloid rhizomes attached to plants that are growing on logs, stumps, or small twigs or branches that have fallen from the trees, and are in a rotting state, than on plants growing in the soft earth and moss. Also, the tubers, to which these coralloid rhizomes are attached, are often partly exposed, when they become very hard, and moreover, are usually round, as may be seen in our plate, and not soft and elongated, as is usually the case when the plants are growing in damp moss.

Passing on to PLATE No. 284, we will commence with FIGURE

No. 2, which shows the very commencement of the new tubers. These two plants were gathered on July 16 of the present year (1923), which, as everyone will remember, was a very cold and backward one, so that some little allowance must be made in all my dates for a very forward season. These little tubers, as will be noticed, have each developed on the left-hand side of the parent tuber, which seems to be the more general rule, although of course one finds them on the right-hand side also. In about a month's time, the leaf will begin to appear, as shown in FIGURE No. 4, this plant, as a matter of fact, being the most forward one I could find at the time (Aug. 14), as in all the others the bud was in a hard and closed state. As a general rule, only one old season's tuber is found remaining, but in this case there are two, and the old leaf for the second year is still in good preservation. Baldwin in his "Orchids of New England," 1884, p. 50, is certainly making use of a figurative expression, when he speaks of the leaf shrivelling up a week after the flower has bloomed. In the present instance, nearly twelve weeks have elapsed since the flower died down, and still the leaf is in evidence, and this is not an isolated case, although perhaps somewhat exceptional. In FIGURE No. 2, the leaves are much more shrivelled up, although only eight weeks had elapsed in this case since flowering time. Passing on to the next stage, we see in FIGURE No. 1 that the leaf has fully developed, and that the flower bud is just appearing. This plant was gathered on September 3, and, it will be noticed, has a fine coralloid rhizome. The last stage of all is seen in the small plant in the top right-hand corner of PLATE No. 283. It was gathered on November 17, 1923, (the same year as all the others were), and is typical of the stage in which the species passes the winter. Returning to PLATE No. 284, FIGURE No. 5 represents an interesting little plant, on account of its having a rather different root system, *i. e.*, the tubers are not side by side as is usual, but one above the other. I have a photograph of a very fine plant taken on May 27, 1923, showing a more pronounced form of root system even than this, the two tubers being one above the other, and connected only by what, presumably, is a very slender internode. This plant is 16.50 cm. in height, and has a leaf 6 cm. long by 2.50 cm. in width, while there is a small coralloid rhizome at the base of the lower tuber, the same as in FIGURE No. 5, which plant was collected on August 24, 1923.

We now come to the last figure of all, No. 3, the large central onewhich, although the last, is by no means the least interesting, in fact, to some it may prove the most interesting. To begin with, it is the finest example of a coralloid rhizome I have ever found, or perhaps am ever likely to, and fully demonstrates the fact already mentioned, that these coralloid palmate bodies can be found attached to adult, equally as well as to young, vegetative plants. Then again, the general rule is broken, for, instead of there being only one new tuber, there are two, one on the left-, and one on the right-hand side of the parent tuber. Should these three have remained in evidence until the new tuber for 1925 had developed, one might have been led astray by imagining they represented four generations, whereas, they would only represent three, the same as FIGURE No. 4. This fine plant was collected on October 2, 1923, and of course at this late date, shows the leaves fully developed, and the flower buds nearly in the stage in which they would pass the winter.

I share the feeling with many others that it was a poetic grief when the name of this lovely little orchid was changed from *Calypso borealis*, "Nymph of the North," to *Calypso bulbosa*, a change apparently not in accordance with facts, since Calypso does not spring from a bulb, but from a tuber, and therefore "Calypso tuberosa" would probably have been more to the point. To most of us, these nomenclatural matters are a worry and vexation of the spirit, and to be conversant with all the names that many of the plants have masqueraded under from time to time, one requires to be a veritable walking encyclopaedia.

In conclusion, to obtain the material for this paper, I have visited the haunts of Calypso in every month of the year, so that I may fairly claim to have more than a nodding acquaintance with the goddess. Needless to say, this acquaintance has been enhanced, and perpetuated, by the beautiful photographs, from which the plates have been made. These photographs are life size, and were taken by the Geological Survey, Ottawa, from the living plants as I sent them in, and my best thanks are due to Dr. M. O. Malte, Chief Botanist, National Herbarium, Ottawa, who has made it possible for me to obtain them, and in other ways has rendered me invaluable assistance.

HATLEY, QUEBEC HENRY MOUSLEY.

1 2 3 4 5

CALYPSO BULBOSA

AUSTRALIAN PLANTS[1]

In addition to their beauty, most plants from Australia are fascinating because of their distinctiveness. Their general appearance seems entirely different from that of plant forms from other countries.

While American and African deserts have thick, water-holding structures, the arid regions covering great areas in West and South Australia have plants with little flesh, with stem-like organs taking the place of leaves, and devices adapted for the use of little water, giving off little of that by evaporation. So we find there some three hundred kinds of Acacias whose foliage is not made up of leaves but of broadened stems, and quantities of plant forms seemingly made up entirely of stem-like needles. Even the tropical plants of North Australia appear out of place in our greenhouse tropical flora.

We Easterners do not profit so much by the plant-life brought back from the land of kangaroo. In our outdoor garden we know well only the Strawflower, or Australian Everlasting, which we grow from seed each year for floral beauty and winter bouquets. In the greenhouse we use such plants as the Australian Fan Palm, the Araucaria "Pines," the Darling Pea, the Swainsonia grown by our florists, the Silk Oak, the yellow- and bronze-flowered show plant Chorizema, and the fragrant gold-, lemon-, and sulphur-colored Acacias.

But in Florida and more especially in California, the Australian plants are wonderfully successful. In central and southern California hundreds of kinds of them are grown, from the extremely important timber genus Eucalyptus, to the little ground-cover, Australian Blue-bell. In our climate these plants are grown in cool, airy houses. In the N. Y. Botanical Garden many are planted out in the great Central Display House where this lecture was given. Some are short-lived, as with the beautiful Acacias, and must be renewed from time to time. Some of the great trees, notably the Bunya-bunya, the Moreton Bay Pine, the Blue-Gum Eucalyptus, and the Queensland Tulip Tree, grow up until they reach the glass dome. One of these trees, the Silky Oak, has been adopted by our florists as a foliage

[1] Abstract of a lecture given in the Central Display House of Conservatory Range 2 on Saturday afternoon, December 1, 1923.

plant, because of its graceful fern-like leaves. It is grown from seed and is used only in a young state, so we have a potential 150 ft. tree as a window or house plant, while in southern Florida and California and the West Indies it is used as a lawn tree. There are about two hundred near relatives of this Silky Oak, or Grevillea, in Australia, and many more hundred distant relatives, in the Protea Family, known the world over for the oddity, in some cases the size, of its flowers. A plant of the alpine Grevillea, blooming in a cool greenhouse, was shown in flower.

In Conservatory Range 1 can be seen the Banyan Tree of Australia, *Ficus rubiginosa*, the Fan Palm, *Livistona australis*, and the largest of the three great Bunya-bunya trees. In the Central Display House are two more of these oddities of the Pine Family, magnificent specimens of the rich green Moreton Bay Pine, and two tall Queensland Tulip Trees, with dark green oak-like leaves. The Acacias, which, Allan Cunningham said, greeted him first at every turn during his four years' exploration, usually bloom in our greenhouses in January, February, and March, but the drooping sprays of pale yellow are covering plants of Fraser's Acacia early this season, and a fine plant of this may be seen, all gray and yellow, near the east door of the Central Display House.

We have the Brisbane Box Tree, *Tristania conferta*, an evergreen shade tree of the boulevards of New South Wales, which is hardy in Florida and California, and the Victorian Box, *Pittosporum undulatum*, used as an avenue tree in southern California, and planted near summerhouses for its orange-blossom fragrance.

In the west end of the Central Display House, the Queensland Tulip Trees, the Bottle-brush and the Araucaria "Pines" are planted out, with Hakeas, Myrtles, and other shrubs underneath them, Lomatia and other short shrubs making low foliage, and *Moraea Robinsoniana*, an Iris relative, placed with its large flag-like foliage at the water edge in the center of the house, making a natural plantation of species almost entirely Australian.

There are, however, many plants distributed throughout the collections which are quite similar to their relatives from other countries.

A stag-horn fern, *Alcicornium bifurcatum*, has the horn-shaped leaves of other sorts of this type of fern, but with slightly longer and narrower divisions. The Australian Maiden-hair, *Adiantum formosum*, closely resembles those of other countries, the cycads are represented by *Macrozamia Moorei*, *Encephalartos Altensteinii* and other species similar to American and African plants, and the Yew Family is represented by *Podocarpus elata*, specimens of which have been in our collections for twenty-three years and are now medium-sized trees. These are quite similar in many respects to their American and Asiatic relatives. Perhaps the most striking single specimen of Australian plant in our greenhouses is the great Bunya-bunya, *Araucaria Bidwillii*, which has a trunk one foot in diameter, with pendent branches ten feet long, and has to be cut off periodically to keep it from going out through the dome roof of House No. 13 of Conservatory Range 1.

KENNETH R. BOYNTON

WHEN A TROPICAL VEGETATION FLOURISHED IN ALASKA[1]

Alaska has an area of about 600,000 square miles, an area equal to all that portion of the United States that lies east of the Mississippi River. The greatest north and south extent—from Point Barrow on the Arctic Ocean coast to the southernmost of the Aleutian Islands is approximately equal to the distance from the northern boundary of Minnesota to the southern boundary of Arizona. The greatest east and west extent is from the southern extremity on the mainland, at lat. 54° 40′, to the westernmost of the Aleutian Islands—a distance about equal to that from Savannah, Georgia, to Los Angeles, California.

The range of climate —the difference between the extremes of winter cold and summer heat—is greater than that between Maine and Florida. In the extreme north it is arctic in its severity. In the southern part the mean annual temperature is about equal to that of Washington, D. C., but the extremes are not so great. At Sitka the lowest record is —2° F. and

[1]Abstract of a lecture given in the Central Display House of Conservatory Range 2 on Saturday afternoon, December 15, 1923.

the highest +90° F., while in Washington the extremes are approximately − 8° and +100°. The character of the living vegetation is, therefore, widely different in different parts of this Territory, but it may be described in general climatic terms as boreal in the northern part and temperate in the southern part.

The evidence derived from studies of the fossil plant remains, however, indicates that up to comparatively recent geological times—certainly as recent as the Tertiary Period—a uniform, subtropical climate prevailed throughout the entire region, up to and beyond the Arctic Circle as far north as surveys and investigations have been prosecuted. Beautifully preserved leaves of fan palms, cycads or sago palms, and remains of other tropical and subtropical trees and shrubs, such as do not now exist further north than southern California and Florida, occur in abundance in deposits of Tertiary age at a number of localities. The climate of the region was, apparently, even in those days, milder than it was in the interior and eastern part of the continent as may be inferred from the fact that similar tropical elements are lacking in collections of equivalent age made in British America and the eastern United States.

The Japan current—the equivalent in the Pacific Ocean of the Gulf Stream in the Atlantic—apparently influenced the climatic conditions at that time as it does today, and gave to our Pacific coastal region a warmer climate than prevailed elsewhere on the continent. At that time, however, there was land connection between Asia and North America, across what is now Behring Strait, and this barrier cut off all connection between the warm waters of the Pacific Ocean and the cooler waters of the north polar region, so that the effects were probably even more pronounced than they are today. During the Quaternary Period, however, a great change of climate took place. The temperature became cooler, and gradually winter and summer seasons were established in place of the uniform mild temperature that prevailed throughout the year. The Glacial Epoch of the Ice Age transformed the entire northern part of the continent into a region of ice and snow, and the tropical vegetation of the Tertiary Period was annihilated. Only one region in the far north escaped complete glaciation—he region now represented by northeastern Siberia and Alaska

—and it was probably in Alaska that mild climatic conditions continued the longest and that it was there that the Tertiary flora made its last bid for life in the north, before its remnants were finally driven south into more congenial climes.

A certain writer of legendary fiction located the Garden of Eden at the North Pole, in recognition of what we know or infer in regard to prehistoric climatic conditions in the arctic regions, and advanced the idea that the flaming sword with which Adam and Eve were driven forth from the Garden was, in reality, the aurora borealis of the Ice Age.

Maps and diagrams illustrating the sequence of the recognized geologic time, divisions and periods, the courses of the ocean currents, former land connections, etc., and photographs of fossil plant specimens, were used to illustrate the facts and inferences presented and discussed.

Allusions were made to personal experiences during a trip of about 1,100 miles by canoe down the Yukon River, when engaged in making collections of the fossil and living floras of the region and studying geological and climatic conditions, past and present, as indicated by the characters of the extinct and the existing floras.

ARTHUR HOLLICK.

GREENHOUSE PESTS[1]

By greenhouse pests we usually refer to parasitic insects and fungi, but the subject might be extended to include the destructive work of rats and mice, which is sometimes very great. Confining the subject mainly to insects or insect-like organisms and fungi, these were taken up in order of their importance.

Probably the most destructive insects in conservatories are the scale insects and their allies, of which there are many different kinds. Unfortunately, from the standpoint of the speaker, the plants under glass are kept so clean that it was difficult to get really good illustrative material and it was necessary to go outside in order to obtain specimens which would show what these insects could do if not held in check. A number of inter-

[1] Abstract of a lecture given in the Central Display House of Conservatory Range 1 on Saturday afternoon, January 5, 1924.

esting species were gathered rather sparingly from the collections, among these the cochineal bug (*Coccus Cacti*) which grows on cactuses and may do much damage unless checked. This is the insect which yields the well-known cochineal dye. Other sucking insects were referred to, including the aphids, thrips, red spiders, etc.

In point of numbers, the ants are about the most conspicuous insects in the greenhouse or perhaps they merely attract more attention because of their activities. One is inclined to wonder why these active creatures are continually running up and down the stems of the larger plants. For the most part they are not directly harmful but follow other insects, especially aphids and scales, in order to feed upon the honeydew which is excreted by these little animals and upon which some ants are largely dependent for food. So much is this true that the aphids have been referred to as the ants' "cows" because they obtain honeydew from them by stroking them with their antennae in much the same way that we obtain milk from cows. In order to increase their food supply, the ants are inclined to nourish these offenders and to ward off their natural enemies, thereby greatly increasing their numbers. So that ants are, for the most part, indirectly harmful rather than directly so, although in some cases they do attack plant tissues.

Reference was made to the work of natural enemies in controlling insects harmful to plants. A tomato worm was shown which had been parasitized by a little fly. The eggs of the fly are deposited in or on the skin of the large caterpillar. When the maggots are ready to form their cocoons they stand them erect on the body of the tomato worm, which then appears to be covered with little balloons, perhaps a hundred or more in number. From each of these cocoons an adult fly emerges and is ready to attack another caterpillar. Much is accomplished by such agencies as this in controlling destructive insects.

The fungi are one of the chief causes of plant diseases but in the greenhouse they are rather less harmful than insects. The sooty mold, which overruns plants, is a secondary consideration, like the ant. The mold, like the ant, feeds on the honeydew deposited by certain insects. The best means of checking this fungus then is to keep the plants clear of insects.

Some attention was given to the various remedies employed

in the greenhouse for checking the work of insects and fungi and the methods of applying them, and a number of illustrations of parasitic fungi were shown.

FRED J. SEAVER.

TROPICAL FERNS[1]

People who think of the matter at all often think of the ferns as being a more conspicuous feature in the flora of the tropics than in that of temperate regions, but whether this is really true or not depends very much upon local conditions. On most of the Bahama Islands, where the soil is dry and rocky and on the dry southern slopes of the larger West Indian islands, such as Jamaica and Porto Rico, where the rainfall is light, as compared with the amount of evaporation under the scorching rays of the tropical sunshine, the ferns are usually rare and inconspicuous. In such places, as also in Bermuda, which is not really tropical, the ferns are found chiefly in shaded sink-holes and caverns, where moisture is more readily conserved. But in the more humid parts of the tropics, as on the northern slopes of the mountains of Jamaica and Porto Rico, where it rains more or less on nearly every day in the year and where the annual rainfall amounts to 100 or sometimes 200 inches, ferns are often found in great luxuriance and abundance. The late Professor Underwood of Columbia University, one of the most renowned of the American students of ferns, has said that in walking a distance of three miles on one of the paths in the rain forests of the Blue Mountains of Jamaica one can gather as many as one hundred different kinds of ferns without the trouble of stepping from the path.

The Danish fern authority Christensen, in 1913, recognized 7,411 species of ferns in the world as a whole. Of these only a few, perhaps 30, have been found in the Arctic Zone; only about 70 in all of Europe, and about 300, including the fern allies, within the continental boundaries of the United States. It is in the tropics and in the South Temperate Zone that the species are most numerous. The stately and graceful tree ferns and the

[1] Abstract of a lecture given in the Central Display House of Conservatory Range 2 on Saturday afternoon, December 22, 1923.

delicate and sometimes moss-like filmy ferns represent striking extremes as to size.

The so-called "Boston Fern," well known in its numerous forms as a house plant, is a species of Nephrolepis which is native to the tropics, including the West Indies and tropical and subtropical parts of North and South America. Dr. John K. Small reports that in some of the "hammocks" of southern Florida the fronds of this species of Nephrolepis not uncommonly have a length of eighteen feet, "while the maximum length is twenty-seven feet and two inches."

The interesting life-history of a typical fern was traced and the talk was illustrated by photographs and by numerous living plants, representing the principal natural families.

MARSHALL A. HOWE.

THE DISTRIBUTION OF SEED OF THE FRINGED GENTIAN

An offer to furnish seed of the fringed gentian for sowing was made by Dr. George F. Norton in the article on "How to Have Fringed Gentians" in the November issue of this *Journal* and also by the writer in an article by Marian Storm that appeared in the *New York Evening Post* of December 11, 1923.

In response to the requests that have come from readers of these two articles a total of 82 persons have been supplied with from a half-thimbleful to a full thimbleful of seed each. (The seeds are so small that a half-thimbleful includes, it was estimated, at least 2500 seeds.) The requests came from thirteen different states as follows, and in the numbers given: New York, 51; New Jersey, 17; Pennsylvania, 3; West Virginia, 2; and one for each of the following states, Massachusetts, Delaware, Maryland, Indiana, Michigan, Missouri, Arizona, Oregon and California.

The results of these numerous attempts to establish this beautiful wild flower by direct sowings of seed will be of considerable interest. If the species is strictly a biennial, first flowers from these sowings may be expected in the late summer of 1925, with the plants remaining in the rosette stage during the season of 1924. It will be of interest to know if there is

blooming every year after a colony once comes into bloom. After flowering once, fringed gentians die, so the continuation of a colony depends on repeated self-seeding, with conditions favorable to the growth of the seedlings. Considerable fluctuation may be expected from year to year in the number of plants that appear, and especially as many of these plantings may be made in localities not fully suited to the plant.

A. B. STOUT.

HOLLY

From many private places in the vicinity of New York comes the lament:—"My holly has been stolen"—"My trees have been cut down after I closed my place." The New York Times stated that "the farmers of Cape May County, N. J., have been sitting up nights with shotguns, loaded with rock salt, across their knees to give a warm reception to thieving intruders, who come in quest of holly and greens. It is from the sale of these that the farmers derive revenue which enables them to pay for their children's education."

At The New York Botanical Garden, after an experience with vandals the year before, all the holly berries within reach were gathered and planted. They are slow in germinating—unless they are soaked in warm water and the berries crushed so as to free the seeds. When eaten by birds and scattered out of doors, they sprout more quickly. We now have in cold frames, and in nurseries, plants ranging from one to four years of age and have started more this year.

Mrs. Baldwin of Maplewood, N. J., writes that for twenty years or more she has often planted her holly berries in pots with other plants in the house and has grown many holly trees on her own place and to give to her friends.

The Baltimore Chapter of the Wild Flower Preservation Society of America, of which Mrs. Bouton is Secretary, has been particularly active in trying to persuade local residents to replant the holly.

Miss Marietta M. Andrews has written the "Lament of the Holly" and this has been presented as a play and a pageant both in Baltimore and Washington. The poem has been re-

printed and may be had from Secretary of the Washington Chapter, Mr. P. L. Ricker, Bureau of Plant Industry, Washington, D. C.

ELIZABETH G. BRITTON.
Secretary, Wild Flower Preservation Society of America.

BIRDS' NESTS IN THE GARDEN

If one may form any opinion from the nests remaining in the trees after the leaves have fallen, then it would seem that a rather larger number of birds than usual raised their broods in the Garden the past year. With the fall of the leaves, too, nests often appear in most unexpected places. That of a robin was built over the main walk leading to the Museum Building and only a few feet above the heads of the passers-by, yet its presence, I believe, was wholly unsuspected till long after the birds had deserted it. Orioles often build only a few yards above well-used automobile thoroughfares. Possibly they have learned that they are better protected from many of their enemies in such situations. A vireo's nest was exposed to view in the fall in such a prominent position that it scarcely seemed possible it should have escaped observation all summer from numerous parties of bird students often gathered only two or three rods away. The nest of a wood thrush may be mentioned, but not in the same class with the above, for it was noted for its conspicuousness, both owing to its position and manner of construction. It was not only built in full view of passers-by but the bird had started the foundation with light-colored paper and one long streamer hung down eight or ten inches below the nest, waving back and forth with every breeze. The wood thrush, indeed, has gained for itself the name of "newspaper bird" from such constant use of paper in nest-making. Just why it is used is something of a question. Certainly it is not for concealment. Can it be that so much is lying about, even the birds think something should be done about it and try to assist the city in its work? In any case the newspaper habit is spreading, for at least one redstart used paper in its nest last year. It did not clear up so much ground as the thrush, but did well considering its much smaller size.

R. S. WILLIAMS.

A COLUMBIA UNIVERSITY COURSE ON NATIVE TREES

Columbia University is offering the following course, which will doubtless be of interest to many readers of the Journal of The New York Botanical Garden:

Agriculture 20—Native trees, conifer and deciduous. Fee $24. Spring Session.

Lectures 4 5 p.m., Thursday. Room 516 Schermerhorn. Instructor, Hugh Findlay, B. Sc. Ag., A. M., Assistant Professor of Agriculture.

Field trips to classify and identify trees with a representative of The New York Botanical Garden.

This course is offered in the hope of increasing the appreciation of trees and to show how such a body of exact information may be applied to various individual and social purposes. The study will begin in February and March when tree characters may be observed under their winter aspects, as well as through their budding, flowering, and leafing in April and May. Field trips, which members of the class may join at their option, will be conducted by a representative of The New York Botanical Garden to give instruction in the identification and classification of trees.

The lectures and the field work will include the following topics: The function of trees in nature; collecting and planting tree seeds; special study of seeds from deciduous and conifer trees; study of tree buds in winter, illustrated with specimens; the principles which govern the composition of the stand, including the pure stand, mixed crops, even and uneven-aged mixtures, nurse trees, and fillers; protecting tree plantings; selecting, planting, and the care of trees for country, town, and city; deciduous trees for lawn and gardens; fruit trees and their place in the garden and lawn; nut trees, their care and culture in the small garden and lawn; evergreens, their care and culture; special study of the pines, with illustrative material; selecting trees that attract the birds; a special study of the economic importance of birds to the forest and home trees, illustrated; trees and their use in a few of our industries, illustrated by a collection of woods showing both color and formation; modern tree surgery, special lecture by expert; tree literature.

Students desiring to take this course are required to enroll at the office of the Registrar, Room 315 University Hall. Applicants are allowed to visit the class once before registering, if they so desire. The course begins February 6, 1924.

There will be a University fee of $6 for each session or any part thereof.

Further information may be secured by addressing the Secretary of Columbia University, New York, N. Y.

PUBLIC LECTURES DURING MARCH

The March program of lectures in the Central Display House, Conservatory Range 2, on Saturday afternoons (3 o'clock), is as follows:

March 1. "Coloration in Ornamental Foliage Plants." DR. A. B. STOUT

March 8. "Cacti." DR. J. K. SMALL

March 15. "The Spices of Commerce." DR. H. A. GLEASON

March 22. "Spring-flowering Bulbs and How to Force Them for the Home." DR. M. A. HOWE

March 29. "Planting Flower Seeds." MR. K. R. BOYNTON and MR. GEORGE FRIEDHOF

Conservatory Range 2 is situated at the eastern side of the Botanical Garden, north of the Allerton Avenue Entrance. It is most conveniently reached from the Allerton Avenue Station on the White Plains Extension of the Subway from East 180th Street. Visitors coming by train to Botanical Garden Station should inquire at the Museum Building.

NOTES, NEWS, AND COMMENT

Dr. and Mrs. N. L. Britton left New York on January 26 to continue their field studies of the flora of Porto Rico. They plan to return late in March.

Dr. A. B. Stout, of the Garden staff, gave an illustrated lecture on "Lilies: Varieties, Culture and Propagation" before the Worcester County (Mass.) Horticultural Society on January 31.

A class of biology pupils from Central High School, Newark, New Jersey, spent December 31 at the Garden with their teacher, Mr. Goldsmith, and a member of the Garden staff, who acted as guide and docent.

In transferring a Cissus vine from one end to the other of House 14 of Conservatory Range 2, a seemingly dead piece of several joints of stem without root was left at a considerable elevation by the gardener. Under the influence of warmth and moisture this has sent down long slender air-roots several feet long, and is in a flourishing condition.

Miss Katharine D. Kimball, who was an efficient museum aid at the Botanical Garden from June 1, 1910, to July 1, 1918, met a sudden and untimely death on January 12 by being struck by an automobile on the streets of Washington. She had been for several years an assistant in the U. S. National Herbarium, where she had given special attention to the grasses.

Professor Romyn Hitchcock, chemist, botanist, and microscopist, recently of Ithaca, N. Y., died in Baltimore on November 30, at the age of 72. In recent years he had been especially interested in the Characeae or brittleworts and had occasionally visited the Botanical Garden to consult the extensive collection of these plants brought together by the late Dr. T. F. Allen.

Biology classes of the Morris High School, numbering about 650 pupils, visited the Botanical Garden on the morning of January 21. And on the morning of January 24, the Museum and Conservatory Range 1 were visited by about an equal number of biology students from the Evander Childs High School. In each case a lantern-slide lecture on forestry was given by one of the High School teachers.

Professor H. M. Fitzpatrick and Mr. D. S. Welch spent some time at the Garden during the early part of February. Mr. Welch is preparing a monograph of the genus *Cucurbitaria*, one of the genera of the lower fungi, and Professor Fitzpatrick is continuing his research work on other genera of the same group.

Dr. Sanford M. Zeller, of the Oregon Agricultural College, visited the Garden during the Christmas holidays to examine specimens of underground puffballs (Hymenogasters). Very few of these fungi occur in the eastern United States, but they are quite frequent on the Pacific coast, especially in California.

The Garden has recently received from Mr. Bertrand H. Farr

of the Wyomissing Nurseries Co., Wyomissing, Pa., the gift of two plants each of fifteen different kinds of day lilies (*Hemerocallis*), including all the species of the genus and all of the best varieties now in cultivation. These plants will be used in experimental studies of sterility and in the breeding of the day lilies—projects now well under way at the Garden. They will also be propagated for general use in display plantings.

The Botanical Garden is fortunate in having one large and several small plants of the beautiful palm, *Livistona Hoogendorpii*. The specific status of this Livistona has never been correctly determined. It was first listed in the 1866 catalogue of the plants of the famous botanic garden at Buitenzorg, Java, but has not appeared there since. However, it has been cultivated in many places since and has been accredited with specific rank in horticultural publications, as a native of Java. The most striking attributes of this palm are the rich dark red color of the leaf-stalks which have very long sharp spines, also colored, and the rich green leaves, divided into about a dozen segments.

The fungus *Anthurus borealis* Burt seems to have become a permanent resident of the Botanical Garden. A group of about 30 specimens was found growing in the Phlox bed. Another fungus, *Scleroderma verrucosum* Pers., so very common on the forest floor of the "Hemlocks" in 1922, was totally absent this last year, owing no doubt to the very dry summer. Repeated searching failed to reveal a single specimen but, no doubt, the mycelium still remains active and will produce fruiting heads this year should conditions be favorable for their emergence.

A specimen of the Wayfaring Tree, *Viburnum Lantana*, a large shrub of the Honeysuckle Family, native of Europe and western Asia, flowered in the Fruticetum the latter part of December and early in January. The Japanese Quince, *Chaenomeles japonica*, and the Golden Bell, *Forsythia suspensa*, were also flowering at that time. The Chinese Witch Hazel, *Hamamelis mollis*, the Japanese Witch Hazel, *Hamamelis japonica*, and the Spring Witch Hazel, *Hamamelis vernalis* of the south central United States, were in full bloom on January 15. The witch hazels are either among our earliest shrubs to flower in the spring or the last to bloom in the fall.

On account of a necessary thinning process, only one branch of our Loquat tree in the warm-temperate collection, Central

Display House, Range 2, bears any of the somewhat pear-shaped yellow fruits whose pleasantly acid flavor delighted many guests last year. Then the tree was over-crowded, now there are less than a dozen of these fruits. The Loquat is cultivated commercially in California, and for ornament in our southern states. Another subtropical fruit plant, the Feijoa or Pineapple Guava, flowers freely about this time of the year, but since 1917, when it was illustrated in Addisonia (**2**: 37. *pl. 59*), we have watched for fruit in vain. Dr. A. B. Stout has solved some of the problems of the setting of the fruit in California, and it is expected that the results will be published in the near future.

Meteorology for December. The total precipitation for the month was 4.60 inches, of which 0.10 inch (1 inch by snow measurement) fell as snow. The maximum temperatures recorded for each week were 60° on the 6th, 64° on the 13th, *65.5° on the 21st* and 50° on the 28th. The minimum temperatures were 31° on the 4th, *19° on the 15th*, 21.5° on the 19th and 26.5° on the 25th.

Meteorology for the year 1923. The total precipitation for the year at The New York Botanical Garden was 38.20 inches. This was distributed by months as follows: January, 6.70 inches (including 22.5 inches snow measurement); February, 1.92 inches (including 15.4 inches of snow); March, 3.31 inches (including 6 inches snow measurement); April, 2.66 inches; May, 2.03 inches; June, 2.95 inches; July, 1.73 inches; August, 1.21 inches; September, 3.33 inches; October, 4.29 inches; November, 3.47 inches; December, 4.60 inches (including 1 inch snow measurement). The total snowfall for the year was 44.9 inches. The maximum temperature for the year was 100.5° on the 21st of July; the minimum was +6° on the 31st of January. The first hard killing frost of the autumn was on the morning of the 2nd of November, when a temperature of 26° was reached. The latest freezing temperature of the spring was on the 18th of April, when the temperature was 31°.

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THE LAND WHERE SPRING MEETS AUTUMN

JOHN K. SMALL

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PUBLIC LECTURES DURING APRIL

NOTES, NEWS, AND COMMENT

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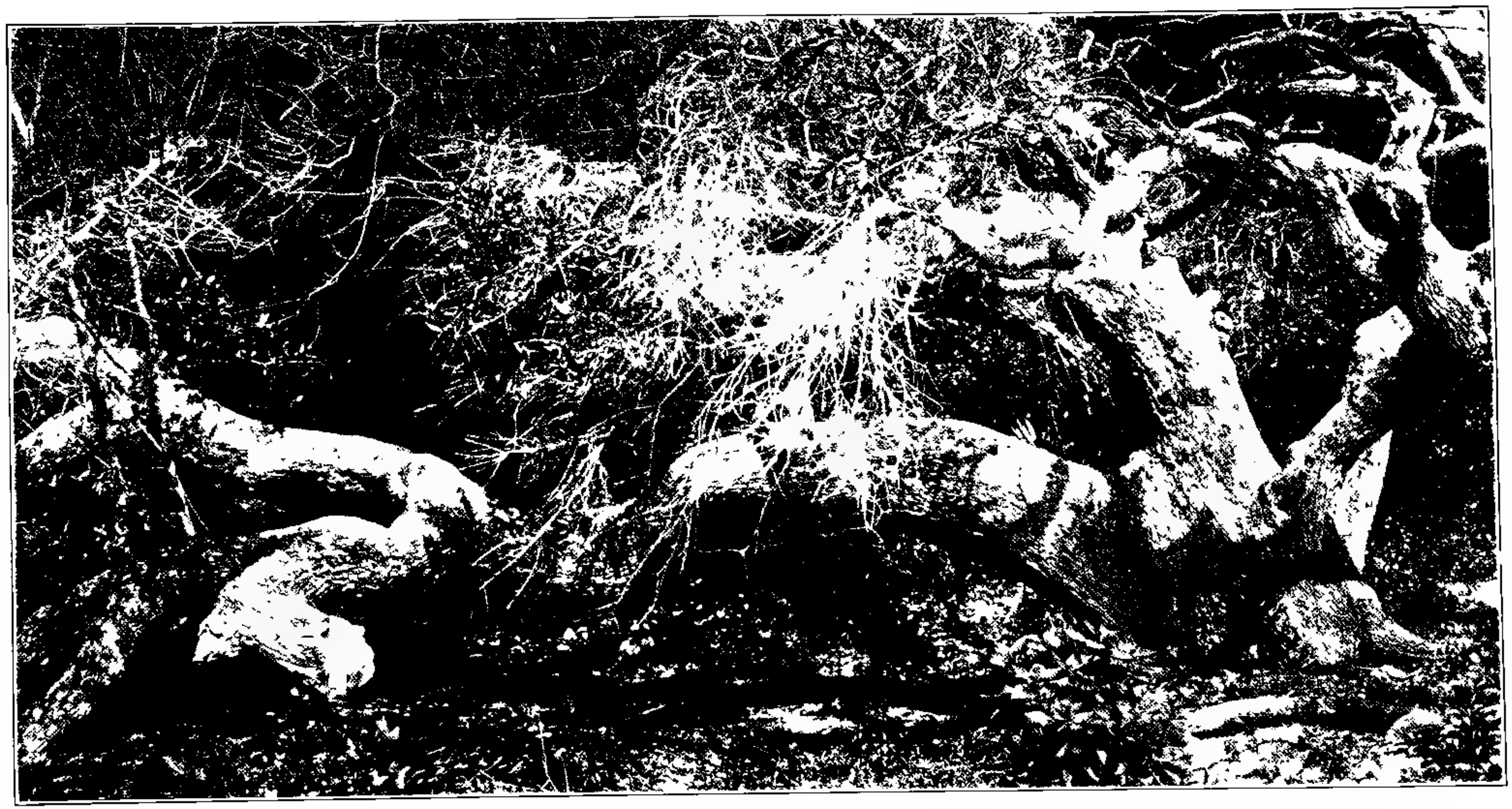

On Green Mound—kitchen-midden—on dunes north of Mosquito Inlet, Florida. Should the old sprawling live-oak (*Quercus virginiana*) be considered a vine or a tree? It is growing in a soil of oyster shells and clam shells. Most of the live-oaks on this and neighboring middens assume this diffuse habit. Some of the saurian-like branches trail on the ground. A woody tropical associate, wild coffee (*Psychotria undata*) is near the base of the trunk.

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THE LAND WHERE SPRING MEETS AUTUMN

A Record of Exploration in Florida in December, 1921

By holding the right hand out flat in a vertical plane with the thumb down, it will readily be seen why Florida has been referred to as "the thumb of the United States." The geographic position of this State is, in fact, singularly interesting.

A meridian of longitude passing through Florida divides North America from South America—two great areas quite different botanically—and places the former, for the most part, to the westward of the meridian, and the latter wholly to the eastward of it. In the Eastern Hemisphere, the corresponding meridian divides Asia into an eastern and a western part, runs through Malaysia, and separates, so to speak, Australia from the Indian Ocean at a point which is antipodal. Its belt of latitude passes through the Desert of Sahara, Arabia, the southern peninsulas of Asia, Formosa, northern Micronesia, Lower California, and northern Mexico.

Florida, largely as a result of this peculiar geographic position and of its physiography, also functions peculiarly from a botanical standpoint, just as the thumb functions differently from the rest of the hand, for its floristics are quite distinct from those of any other State in the Union. Within its political boundaries many elements of the floras of the temperate regions and of the tropics not only meet but commingle, and are also associated with an extensive endemic flora. Furthermore, there are instances where the same species, native or naturalized, or closely related ones, occur both in Florida and in the regions of corresponding longitude and latitude mentioned above.

Furthermore, the usual vernal awakening of some of our common coastwise plants is really autumnal in peninsular Florida.

Botanically, winter is eliminated—hence, "The Land where Spring meets Autumn."

Drawn southward by the great floral magnet of that land of perpetual bloom, George K. Small and the writer set out for the Florida peninsula during the last week of November, 1921. The following narrative and plant notes are the results of about four weeks' exploration on land and water, made possible by the personal interest of Mr. Charles Deering.

North of the Carolinas the landscape was desolate, the early frosts having removed nearly all green vegetation, except here and there that of such cultivated plants as privet (*Ligustrum*) and Japanese-honeysuckle (*Nintooa*). The bleakness of the outlook was intensified by a heavily overcast sky. The poor hills of Maryland and Virginia, however, with several kinds of pines (*Pinus virginiana, P rigida, P Taeda*) and the laurel or calico-bush (*Kalmia*) lent variety to the landscape.

In the Carolinas and Georgia there were everchanging pictures in view. Patches and banks of various shades of red and yellow of the maples (*Acer*), the tulip-trees (*Liriodendron*), the sour-gums (*Nyssa*), and the sweet-gums (*Liquidambar*), here lent variety to the view, but these also were set against the sombre background of the various pines. As was the case earlier in the season at the North, the colors were not so brilliant as usual, a condition resulting, perhaps, from the prolonged drought of the preceding season.

In the deeper swamps with their more tempered conditions some of the narrow-leaved oaks still held their foliage, whereas the broad-leaved oaks of the highlands had long since dropped their leaves. The leafless condition of the trees made the often present evergreen parasite, the mistletoe, with its white berries, very conspicuous against the sky. Another prominent evergreen, but this time with berries that were red, was the holly (*Ilex opaca*) in the lowlands. This tree, which is our counterpart of the European holly, has a wide range, both in latitude and in altitude. One noteworthy fact is that it thrives equally well in the warm moist lowlands and on the cool dry slopes of the high mountains. Great quantities of this species, sometimes called American holly, as well as the Dahoon-holly (*Ilex Cassine*) and the Cassena or yaupon (*Ilex vomitoria*) are gathered for decorations at Christmas time. The holly last mentioned fur-

nished the black drink of the early American Indians.[1] Its eaves contain a small percentage of caffeine, and these were used both ritually and medicinally, by the Indians, not only where the plant grew, but also at a distance. So important was the plant considered that periodical expeditions were made, often from the remote interior, to the coast for the sole purpose of gathering a supply of the leaves. It was called "asse-laputsca" (small leaves) by the Creeks and long served as a valued article of trade.

The only conspicuous flower to attract one's attention north of Georgia was a member of the vast thistle family, a kind of beggar's-tick (*Bidens*) with yellow heads of flowers which brightened the pools and ditches. South of the Altamaha River in Georgia a plant of the great pea family, a purple lupine (*Lupinus Nuttallii*) was in flower on many of the sandy hillsides. This species is the counterpart of our more northern and larger *Lupinus perennis*.

We were surprised to find a dearth of plants in flower in northern Florida. Recent frosts, however, had interrupted the winter flowering of most of the plants, even the common and everblooming weeds being few and far between.

From the Saint Marys to Cape Sable

After arriving at Jacksonville we made our way back to Saint Marys in the southeastern corner of Georgia, for the purpose of studying the large-jointed prickly-pear discovered there the year previous. This cactus proved to be a brown-spined species, but apparently not a member of the brown-spined group which is typically West Indian, with only one endemic species (*Opuntia zebrina*) heretofore found this side of the Gulf Stream in southern Florida. As is the case in most of the species of *Opuntia*, the young spines are pale, in this case yellowish, but later on they turn reddish-brown and then brown. Associated with this large prickly-pear was our smallest one—the crowfoot prickly-pear (*Opuntia Drummondii*). Both kinds grew on the grassy plain-like dunes where a number of cedar-trees that survived the axe of the pencil-maker stood. Curiously enough, the little prickly-

[1] This should not, however, be confused with the present-day "black-drink" of the Florida Seminoles, which is a decoction of the root of an eryngo —*Eryngium synchaetum*.

pear was found only close to the bases of the trunks of the cedars. The existence of this fragile-jointed cactus there was doubtless due to the protection from grazing animals and coastal winds afforded by the tree-trunks.

Eastward from where we crossed the Saint Marys going southward the day before, the climate was, apparently, more tempered. Consequently, a few plants appeared in bloom. In the dry pinelands two kinds of aster constituted the total—the one (*Aster adnatus*) with bright blue rays, and occasionally albino plants, the other (*Aster concolor*) with rich purple rays. The former plant is noteworthy on account of the leaf-structure, for each leaf-blade is grown fast to the stem or branch which bears it—hence the specific name *adnatus*. In the low or moist pinelands a small ladies'-tresses (*Ibidium*) with its twisted slender spikes of white flowers strictly erect and a low milkwort (*Polygala nana*), with its stout racemes of greenish-yellow flowers depressed among the grass, appeared occasionally. The only other plants in bloom were the quinine-plant (*Sabbatia Elliottii*), blue-lobelia (*Lobelia glandulosa*), golden-aster (*Chrysopsis graminifolia*), and tickseed (*Coreopsis Leavenworthii*). There were large swamps along the way with an almost pure growth of the loblolly bay (*Gordonia Lasianthus*). These swamps are surely decorative in spring when the large camellia-like flowers of the bay are open. Even in midwinter they are not without decorative effect, for many of the trees are copiously overrun with the large laurel-greenbrier (*Smilax laurifolia*), which bears myriads of berries that are green or white when young and black when ripe. In company with the bay were giant plants, as high as one's head, of the cinnamon-fern (*Osmunda cinnamomea*) which, in spite of the season, was in full "flower" and very conspicuous on account of the numerous red spore-bearing leaves.

Turning eastward at Yule, we were soon on Amelia Island. Fort Couch, at the northern extremity of the Island, was our proposed destination, but the high tide prevented us from driving up the beach, which is the only land route by which the fort can be reached. We did not get further than the dunes and beach east of Fernandina. There the vegetation of the dunes presented an unusual appearance. The recent storm had whipped off most of the oak leaves; consequently, instead of the usual banks of greenery, large areas of gray—the massed gray myriad

branchlets of the oaks—appeared as far as the eye could see. Evidences of the violence of the storm which swept the Florida peninsula in a general course from northeast to southwest, presented themselves wherever we went. The drenching rain accompanying the storm, the mild weather, and several subsequent rains, combined to bring forth fungi. We observed more specimens of this group of plants in that December than we had seen in nearly twenty years combined.

A little time was devoted to the vicinity of the old settlement of Fernandina, which lies to the northward of the present town.

The dunes facing the river and marshes supported a copious growth of a large prickly-pear similar in habit to the one growing at Rockville, South Carolina, described as *Opuntia tunoidea*.

Inquiries addressed to a native as to whether there were other kinds of prickly pears thereabouts, brought a negative answer, yet his shoes bore joints of the crow-foot prickly-pear (*Opuntia Drummondii*), which is very plentiful on the dunes,—an example of how far one can safely depend upon local information, at least as regards plant life.

Two showy shrubs were in bloom and in fruit, both wild plants—*Lantana horrida*, so named from the stout and numerous prickles on the branches, and *L. Sellowiana*, a native of South America and named for the discoverer. The former has variously colored flowers ranging from yellow to red and purple; the latter has purple flowers of different shades. Both of these plants grew intimately intermixed with the large cactus referred to above.

The tempering effect of the surrounding waters and marshes was shown by the numerous weeds in bloom everywhere. About ten kinds were in evidence—among them, two sennas (*Cassia Tora* and *C. occidentalis*), mallow (*Sida carpinifolia*), wild heliotrope (*Cochranea anchusaefolia*), and heterotheca (*Heterotheca subaxillaris*).

In the gardens of Fernandina numerous tender plants were in flower—among them, sago-palm (*Cycas*), lilies (*Crinum*), poinsettia (*Poinsettia*), oleander (*Nerium*), camphor (*Camphora*), Madeira-vine (*Boussingaultia*), banana (*Musa*), begonias (*Begonia*), coleus (*Coleus*), wild-jessamine (*Clerodendron*), turk's-turban (*Siphonanthus*), and jimsonweed (*Datura*).

These preliminary excursions being accomplished, we set out

for one of our main objectives, namely, Cedar Keys. A rain storm set in, but our drive from Jacksonville to Saint Augustine, through an almost flowerless country, was otherwise uneventful. Between Saint Augustine and Palatka the pinelands and the landscape often quite duplicated those north of Jacksonville. The Saint Johns River and its tributaries, however, supported a copious growth of water-hyacinth (*Piaropus*) and water-lettuce (*Pistia*).

On the western side of the Saint Johns River we were introduced to a different kind of country. There was a succession of blackjack ridges, "scrub," savannahs, and high pineland. The floristics were very different from those on the eastern side of the river. More than a dozen plants, many of them quite showy, were in bloom. There were goldenrods (*Solidago*), asters (*Aster*), lobelias (*Lobelia*), meadow-beauties (*Rhexia*), and tickseed (*Coreopsis*). We soon crossed narrow stretches of the "scrub" that represents a northward continuation of the great area of "scrub" lying west of Lake George and which comprises a large part of the Ocala Division of the National Forest.[1] The rosemary (*Ceratiola*) was present in the "scrub." Several lakes appeared as we crossed the northern extremity of the lake region. These, as we began to ascend to the higher country of the middle Florida hammock belt, were often encompassed with a growth of hammock composed of live-oak trees. On the sandy hills prostrate plants were much in evidence; even the widely naturalized Asiatic rose (*Rosa bracteata*) covered large areas with the stems closely appressed to the sand. Three humble, herbaceous, mat-forming plants were plentiful: a yellow wood-sorrel (*Xanthoxalis corniculata*), a purple-flowered tick-trefoil (*Meibomia triflora*), and a portulaca (*Portulaca pilosa*). A prostrate prickly-pear (*Opuntia lata*) with red clavate fruits was present. It was discovered on the western side of Gainesville several years ago.

On the backbone of the peninsula, so to speak, the cabbage tree reappeared, but in much less numerous individuals and thinner colonies than on the coasts and often seemingly out of place with its associated vegetation. In fact, large areas in the interior of the upper parts of the peninsula are palmless, a condition giving the country a peculiar aspect after one is used to traversing the densely palm-inhabited parts of the State.

[1] Journal of The New York Botanical Garden **21**: 28–32.

An introduced endogen—Natal-grass (*Tricholaena*)—so common in the southern part of the State, has established itself in the Gainesville region. With the horizontal rays of the setting sun two kinds of brightly colored flowers were particularly conspicuous, the one a rose-purple foxglove (*Agalinis*), the other a dark-purple lobelia. Both plants are inhabitants of low grounds, and, curiously enough, the corollas of both are two-lipped and conspicuously obliquely flattened; that is, with the upper lip bent back over the tube and the lower lip projecting forward in the same plane.

We went "over the top" near Gainesville just after sundown, and, continuing on toward the western coast as far as Archer, the next forenoon found us *en route* to Cedar Keys. The first third of the way lay over a series of black-jack ridges and pineland where the coontie (*Zamia integrifolia*) reappeared. The ridges also yielded a new kind of blue-curls (*Trichostema*), and several composites were blooming. Further westward, cypress-swamps and broad-leaved swamps alternated with the pinelands. The greatest of the swamps, the Gulf Hammock, has been the source of the red-cedar for the lead-pencil industry for several generations and also a mecca for the mighty hunter of both small and large game. Three kinds of palms—the cabbage-tree, the dwarf-palmetto, and the saw-palmetto—were soon in evidence when we got back on the pleistocene formation which we had left behind on the eastern coast. Hammocks back of Cedar Keys were made up largely of oaks (*Quercus*), hickories (*Hicoria*), magnolias (*Magnolia*), sweet-gum (*Liquidambar*), maples (*Acer*), and red-cedar (*Sabina*), with willows (*Salix*) and sweet-bay (*Magnolia*), also prominent features in the lower country. Savannahs covered with cat-tails, rushes, grasses, and water-hyacinth, gave way to the salt marshes in which stood islands of pine trees that seemed none the worse for their saline habitat.

Cedar Keys, a permanent center of the "shell-fish" industry—for the red man and the white man—was, temporarily, also an important headquarters for making red-cedar pencil-wood during several recent generations. The ancient shell-mounds are at the northern end of the island. About a dozen and a half plants were in bloom on the mounds in late November. Among them were included two palms (*Sabal Palmetto* and *Serenoa repens*), two mallows (*Sida cordifolia* and *Abutilon permolle*), and

two cacti (*Opuntia Dillenii* and *O. Drummondii*), our largest and smallest kinds, respectively, of prickly-pears. These two mounds are very ancient, older, *i.e.*, finished before the oldest trees of the surrounding country began to grow. They are made up of *oyster*, *clam*, and *conch* shells, with several other kinds of sea-shells, all intimately mixed together. The mounds have been partly levelled and much disturbed, so that some of the native vegetation has doubtless been lost to us. Still much of interest remains. Woody plants were in the majority—in respect to kinds—on these mounds. Some of the plants were showy both in flower (*Sida coccinea*, *Monarda punctata*) and in fruit (*Ilex vomitoria*, *Callicarpa americana*). Others might be mentioned. Two very fragrant-flowered plants scented the air far and near, the saffron-plum (*Bumelia angustifolia*) and the saw-palmetto (*Sabal repens*).

A shell-midden up near the delta of the Suwanee River was the next magnet. This, apparently, was the site of an Indian settlement in historic times as well as in prehistoric, for on some of the maps of Florida it is designated as "Indian town." It faces Suwanee Sound and has a maximum elevation of about twenty-five feet above the water. The main object of our search was coontie (*Zamia*), and we found it as soon as we stepped ashore from our boat. The species is *Zamia integrifolia* and it grows from the water's edge to the top of the mound. Many of the plants indicated great age. Those near the beach grew in a mixture of oyster-shells and sand. Single plants were found to have at least a dozen branches, in spite of the fact that these plants are commonly described as simple-stemmed. The underground parts were of sufficient size to fill a real old-fashioned bushel basket. This, like many other coastal shell-middens,—all representing a very recent artificial geologic formation, both in the northern and the southern parts of the peninsula—harbors a peculiar plant-association. Its woody vegetation consists largely not only of berry-bearing shrubs and trees, but of those characteristic of floras further north and of those further south. The various kinds were evidently planted there through the ages by migratory birds.

For example, in this present case we found on the one hand the temperate black-fruited Indian-cherry (*Rhamnus caroliniana*), which ranges down from the mountains, and on the other

the tropical red-fruited wild-coffee (*Psychotria undata*) and the white-fruited snow-berry (*Chiococca racemosa*). Furthermore, instead of growing erect or high-climbing, as they do further south, both of the tropical shrubs were prostrate.

These middens have decided attractions for others as well as for botanists. One of the most persistent local legends is ever that they hide much treasure buried there by the old buccaneers. How firmly the native believes this is evidenced by the much disturbed condition of many mounds, where generations of treasure seekers have dug, and dug again. Some of the local traditions are exceedingly curious. It is variously reported, for example, that many a chest of gold has been seen by the natives, but none has been secured, for when unearthed a mere touch will cause the chest to shift out of reach, and when unearthed again it will repeat its peregrinations. One ingenious native, however, conceived a method which he believed would be successful. He procured a large steam-boiler and removed one end. Thus prepared, he planned to clap the boiler over the chest and thus prevent its escape. However, he made a bungling job, the edge of the boiler touched the chest before it was secured and the chest shifted. The boiler lies there today, awaiting the manipulations of a more dexterous operator.

In the meantime the floristics of the middens remain the most interesting feature—to some of us, at least. Our object being accomplished, we retraced our course as far as the settlement of Bronson and turned southward in quest of more kitchen-middens. We closely paralleled, perhaps, the old trail of the Spanish adventurer Panfilo de Narvaez, who traversed that region four centuries ago. It is needless to say that we saw neither marks of his expedition nor any more gold or silver than Narvaez did. However, as in the case of the shell-middens, the floristics are enticing and in a season other than winter would compel investigation. As it was, only one showy plant was in flower in the pinelands, the bright-purple and fragrant *Carphephorus corymbosus*. There was much vegetation in evidence, however; it was dormant and in the form of rosettes of perennial and biennial plants. Besides the highland plant associations, there were ponds and cypress swamps. The latter, on account of the gray bark of leafless cypress trees and the gray Florida moss, were often mistaken for clouds of smoke when viewed through the pinewoods.

We were not long in reaching the Withlacoochee at the settlement of Inglis. There we visited an aboriginal burial mound in a dense hammock on the shore of the river. Like other burial mounds it supported a growth of trees which were as old as the other trees of the neighborhood and rather larger. Our plan to explore the shell-middens at the mouth of the Withlacoochee, nine miles from Inglis, were frustrated because we were taken to be federal revenue agents. We could not find a friend in that region! Specimens of zamia were collected on the middens at the mouth of the river nearly a century ago, and the mounds have not since been visited by botanists.

Having to be satisfied with promises of a possibility of being able to reach the mouth of the river at a future time, we at once pushed on southward with Crystal River as our objective. North of Crystal River we passsed through a large hammock with many kinds of deciduous shrubs and trees. These inland hammocks have little in common with those along the coast. They are devoid of the characteristic tropical elements. It is true such plants as tallow-wood (*Ximenia*), toothache-tree (*Zanthoxylum*), and coontie (*Zamia*) were present, but the typically more northern plants, such as iron-wood (*Carpinus*), hickory (*Hicoria*), mulberry (*Morus*), and partridge-berry (*Mitchella*) abounded.

The settlement of Crystal River is at the head of the estuary of that stream about ten miles from Crystal Bay and the Gulf of Mexico. The inhabitants are mostly engaged in the fish and "shell-fish" industry, and in addition to this there is a large cedar pencil-wood factory.

It is often surprising (aside, of course, from epiphytes) how little soil is really necessary to support plant growth. Very vigorous specimens of the Carolina-aster (*Aster caroliniana*) were growing in the heaps of oyster shells recently dumped from the canning houses. This species is typically an inhabitant of the alluvium of river banks. The estuary is lined with hammocks. These are often a copious growth of the sombre red-cedar (*Sabina*) banked against the masses of the paler green cabbage-tree. Half way down the river, on the northern side, is a large shell-midden, called "Spanish Mound." It is extensive and stands between twenty-five and thirty feet high. It is built up in the hammock on the edge of the marsh several hundred feet

away from the river. The native flora of the mound is much the same as that of the mounds at Cedar Keys—herbaceous plants being rare and exotics wanting—the isolation of the mound having preserved its native plant covering. There we found two kinds of *Zamia;* the widespread species of the State, *Z. integrifolia*, was plentiful, and a West Indian kind, *Z. media*, was a close second. The latter plant is larger in every way than the former. The deep hammock at and about the mound had an unusual, not to say weird, appearance. The prominent vegetation was composed largely of the two kinds of coonties just mentioned, intimately associated with three kinds of palms—the cabbage-tree, the saw-palmetto, and the needle-palm. We next proceeded down the river bound for the middens at its mouth. The low river margins were lined with the everblooming arrowhead (*Sagittaria lancifolia*), and on the water's surface were many floats of water-lettuce (*Pistia*) and water-hyacinth (*Piaropus*), some with their sails down and quite stationary, others with their sails up and moving about with each vagrant breeze.

The shell-mounds at the mouth of Crystal River lacked the copious arboreous growth of the "Spanish Mound," but the lower woody plant-covering was rampant.

The two kinds of zamia were there and grew luxuriantly. The numerous leaves of *Zamia media*, the larger plant of the two species, were often as tall as one's head. The hammock growth comprised about two dozen kinds of shrubs and trees, many of them in flower or fruit, even in the winter season. The native growth was largely tropical in character and kind—coral-bean (*Erythrina arborea*), stopper (*Eugenia buxifolia* and *E. axillaris*), snowberry (*Chiococca racemosa*), saffron-plum (*Bumelia angustifolia*), and soap-berry (*Sapindus Saponaria*). Present, but less prominent, were the northern elements, Indian-cherry (*Rhamnus caroliniana*) with very narrow leaf-blades, hackberry (*Celtis mississippiensis*), sumac (*Rhus obtusifolia*), and mock-orange (*Laurocerasus caroliniana*). The apparently persistent naturalized plants were the papaya (*Carica Papaya*), the lemon (*Citrus Limonum*), and the lime (*Citrus Lima*).

Upon our return to the settlement of Crystal River we set out for the old settlement of Homosassa, which is situated on the estuary of the Homosassa River, the next stream south of

Crystal River. Black-jack ridges and pineland extend for several miles south of Crystal River. Only two plants were in bloom in the highlands, the one the creamy umbrella-plant (*Eriogonum tomentosum*), the other the showy carphephorus (*Carphephorus corymbosus*). Toward Homosassa we entered a primeval forest, a rather low hammock. Again, this hammock, remote from the coast, showed little of tropical growth. Among the hardwood trees, oaks (*Quercus*), sweet-gums (*Liquidambar*), hickories (*Hicoria*), and blue-beeches (*Carpinus*) were conspicuous. Many trees were felled by the recent hurricane. Their decaying wood will yield a wealth of fungi in due course, as did the humus of the hammock floor as a result of the rains of the hurricane and some subsequent showers. Several kinds of woody vines decumaria (*Decumaria barbara*) and cross-vine (*Anisostichus crucigera*)—clambered over the trees, while the tree trunks were often copiously laden with ferns, such as the resurrection-fern (*Polypodium polypodioides*) and the shoestring-fern (*Vittaria lineata*). The trunks of the hardwood trees were usually tall and associated with them was a remarkable growth of palms. The three kinds of palms mentioned above—cabbage-tree, saw-palmetto, needle-palm—grew in such exceptional abundance that they imparted an unusual aspect to the hammock.

Upon our return to Crystal River we turned eastward toward Inverness on Lake Tsala Apopka. Rolling country, the ridges alternately marked off with either the blackjack or turkey-oak (*Quercus Catesbaei*) as the dominant tree, then the long-leaf-pine (*Pinus palustris*) dominant, and then the "scrub," with its spruce-pine (*Pinus clausa*), altogether suggesting a gigantic ocean-swell, was traversed for many miles. These ridges gain altitude and prominence southward where the country takes on a somewhat mountainous appearance as described in a former paper.[1] At Inverness we turned southward along the western side of Lake Tsala Apopka and the Withlacoochee River. On some of the high black-jack ridges we found the oak trees copiously draped with the Florida-moss (*Dendropogon*) in spite of the fact that it is commonly believed and recorded that this epiphyte is always indicative of wet places. We called at the

[1] Journal of The New York Botanical Garden **21**: 45.

fern-grottoes, described in a former paper,[1] along the Withlacoochee near Pineola, in order to get a supply of fern spores for starting colonies of the rarer kinds in the Deering hammock at Cutler.

The smaller plants of the fern-grottoes are humus-lovers. A copious deposit of humus covers the limestone wherever it is not washed away by rains. The little spiderwort (*Tradescantella*) and the ground-orchid (*Ponthieva*) and some of the herbs and shrubs were in flower and in fruit. The different methods of seed-dispersal were vividly impressed upon us by the plants in the grottoes. The powdery seeds of the orchid mentioned above blew in all directions when the plants were shocked; those of the rampant little valerian (*Valeriana scandens*) were carried about the wind through the agency of feather-like appendages. The seeds of the water-hyacinth (*Piaropus*) and the water-lettuce (*Pistia*) float on the water. Those of the wild-coffee (*Psychotria*) and the bird-pepper (*Capsicum*) pass through the alimentary canal of birds and mammals. The spinescent fruits of the skunk-plant (*Petiveria*) and those of the yellow-mallow (*Pavonia spinifex*) adhere to the fur of animals as they did to our clothes. The fruits of the wild-pepper (*Peperomia cumulicola*) and those of the West Indian grass (*Pharus*) are also distributed by adhering to the fur or feathers of animals, not by spines, however, but by a very viscid coating. Setting out for the western coast again, we went three miles south of Brooksville to visit the only locality for a fern, the West Indian bracken (*Blechnum occidentale*), known this side of the Gulf Stream. The patch of the fern comprises only about fifty square feet. Our common swamp bracken (*Blechnum serrulatum*) has long horizontal rootstocks and stiffly erect leaves. The plants of the rare species have short rootstocks and leaves that often lie flat on the ground.

From Brooksville we set out westward for the Gulf of Mexico. For a distance of four miles west of Brooksville there are high pinelands and hammocks with some red-cedar (*Sabina*), then black-jack ridges appear, ridge after ridge, in great billows, mostly in their natural condition, but in some places extensively cleared, thus presenting a vast rolling country now clothed with Natal-grass. About nine miles out rosemary (*Ceratiola*) ap-

[1] Journal of The New York Botanical Garden 21: 32–38.

peared in the pinelands and within two miles there is "scrub." At the western edge of the "scrub," where it abuts on a black-jack ridge, there emerges an immense spring of clear fresh water—Weekiwachee Spring. In the adjacent "scrub" two woody plants that are not usually associated with the flora of the "scrub" were found—a deciduous-leaved holly (*Ilex* sp.) and the wild-olive (*Osmanthus americana*). Our approach to the Gulf was indicated in the vegetation by the appearance of flaveria (*Flaveria linearis*) and fleabane (*Pluchea*) and soon the vast salt-marshes covered with the brown rush (*Juncus Roemerianus*) came into view. The scenery of these marshes was varied greatly by groups of the cabbage-tree and the saw-palmetto and even by colonies of one of the long-leaf pines (*Pinus Elliottii*). In the immediate coastal region zamia in luxuriant form came to notice, the first we had observed since leaving the Lake Tsala Apopka region.

Nearly or quite all the plant-associations mentioned above were traversed again as we drove southward near the coast. Little of the vegetation appeared in bloom; the knotweed (*Thysanella robusta*) and garberia (*Garberia fruticosa*) showed the only conspicuous flowers and these occurred only where the "scrub" extended to the water's edge. *Zamia* was in evidence as far south as Tarpon Springs, where we lost sight of it. In fact, we found no traces of it in the Pinellas Peninsula, where it would be expected, except as cultivated plants long ago imported from south of the Tampa Bay region. Sad evidences of the recent storm were only too conspicuous as they were recorded in the hammocks by the prostrate trees of all kinds and the general accumulation of debris. The citrus groves, too, exhibited the action of the recent winds in a curious manner. The windward half of each fruit tree showed very pale-green, owing to the tender new foliage that had begun to replace the leaves which had been blown off by the storm, while the leeward side was dark-green, as the leaves on that side of the tree had been able to hold to the branches because some of the force of the wind had been spent on the windward side of the tree.

Night found us in Saint Petersburg, where we had the coöperation of a local botanist, Mrs. Katherine B. Tippetts. The weed, par excellence, of Saint Petersburg is our most recently naturalized rattlebox (*Crotalaria Saltiana*); it is ubiquitous.

Growing with it, occasionally, was the large mallow we had found at Cedar Keys and at Crystal River. The dunes of Long Key were our objectives in that region. There we searched for a peculiar kind of palm that had been reported as growing on the dunes, but without success. However, various forms of the coastal prickly-pear of the Miami region were found to be very common. The woody vegetation was composed almost wholly of berry-bearing shrubs and trees. Much in evidence were the two palms, the saw-palmetto and the cabbage-tree, to represent the monocotyledons. Among the dicotyledons were the sea-grape (*Coccolobis Uvifera*), Florida-privet (*Forestiera porulosa*), myrsine (*Rapanea guyanensis*), lantana (*Lantana ovatifolia*), ernodea (*Ernodea littoralis*), and scaevola (*Scaevola Plumieri*). The only blooming herbaceous plants then adorning the dunes were the tickseeds (*Coreopsis Leavenworthii*), the dune-sunflower (*Helianthus debilis*), and goldenrod (*Solidago angustifolia*). The low pinelands about Saint Petersburg indicated the approach of spring by the numerous flowers of both white and blue violets.

The following day was set aside for the purpose of crossing the Florida peninsula to the eastern coast. Showers during the night had cleared the atmosphere and the deep blue of the sky, the dark green of the pines, and the bright green of the palms were combined into ever-changing pictures of unforgettable beauty as we drove up the Pinellas Peninsula. There we re-crossed, evidently near the present site of Clearwater, the trail of Narvaez, who, in 1528, went inland there.

Narvaez, like most of the Spanish expeditioners, was in quest of gold or other treasure. By the time he reached the present Apalachicola region his expedition had disintegrated. A sub-ordinate, Alvar Nuñez Cabeza de Vaca, with two surviving associates, navigated the Gulf shore to beyond the mouth of the Mississippi River, and wandered westward, crossing the present States of Texas and New Mexico and finally reaching the Gulf of Lower California. They spent eight years in their wanderings. Cabeza de Vaca rather copiously recorded the occurrence of plants and the uses of them for food by the aborigines, particularly the prickly-pears and the palms, as the following quotations will show:[1]

[1] The Journey of Alvar Nuñez Cabeza de Vaca. Translation by A. F. Bandelier, 1905.

"Without finding anything else to eat but palmettos [Saw-palmetto] like those of Andalusia."—Page 19.

"After which time they would remove to another section in order to eat prickly-pears. These are a fruit of the size of eggs, red and black, and taste very good. For three months they exist upon them exclusively, . . ."—Page 81.

"Their best times are when 'tunas' [prickly-pears] are ripe, because they have plenty to eat, . . . When dried they are put in baskets like figs and kept to be eaten on the way."—Page 91.

This old record refers also to the growth of pine trees so characteristic of Florida, and to trees with nuts.

In anticipation of spring, still several months distant by the calendar, violets were in bloom in the low hammocks. After a detour of Old Tampa Bay, as well as several minor detours made necessary by washouts resulting from the recent storms, we reached Tampa, which is situated in a country too long settled and too thoroughly cleared of its natural vegetation to be of much interest from a floristic standpoint. This region was largely flat woods in the earlier days. There the coontie (*Zamia integrifolia*), which is still occasionally in evidence, was first collected on the western coast during the Seminole wars. There, too, we crossed another historic trail—that of De Soto, who landed near the mouth of the present Manatee River a decade after Narvaez landed near the present Clearwater and struck up into the peninsula towards Lake Apopka. The lake region, further east, retains more of its natural conditions. We crossed many blackjack ridges where the upland willow-oak (*Quercus cinerea*) prevailed in place of the blackjack or turkey-oak (*Q. Catesbaei*). Where the long-leaf pine (*Pinus palustris*) invaded these ridges, the dark-green of the pines, placed high above the whitish-green of the lower oaks, was beautifully contrasted against the blue of the sky. Also, anticipating spring, tickseeds (*Coreopsis*) and yellow buttons (*Actinospermum*) often copiously adorned the ridges. In addition to other plants, a knotweed (*Polygonella gracilis*) and froelichia (*Froelichia floridana*), neither of them noted for showy flowers but for their very slender habit and relative great height, often formed large colonies on the ridges. In the midst of the lake region one of the many showy plants that adorn the desert-like sands, in season and sometimes out of it, the shrubby lupine (*Lupinus diffusus*) was observed.

In the Everglades near Royal Palm hammock, Dade Co., Florida. A "gator" hole in an area low enough to be permanently wet, with characteristic plant association. Spatter-docks (*Nymphaea advena*) in the water and cat tails (*Typha angustifolia*) around the edge. In these favorite haunts, the saurians may rest secure in the water under the spatter dock leaves, while the cat-tails give them part shade and protection when they are out for air and sunshine. The water holes often teem, so to speak, with water moccasins

The plants then in evidence were mostly stragglers from the preceding flowering season. The species is noted for its silvery-gray foliage, its racemes of sky-blue flowers and its white-fluffy pods.

In the Kissimmee watershed wet hammocks and cypress ponds became frequent. On the tussocks, aside from the elegant Carolina-aster (*Aster caroliniana*), two more humble plants were in bloom. Each represented the most highly organized family in the monocotyledons and in the dicotyledons. The one is an erect humus-loving orchid (*Ponthieva racemosa*) with greenish-white flowers, the other a mud-loving creeping sunflower relative with yellow heads (*Spilanthes repens*). West of Kissimmee the electric wires were also trellises, for they were covered with two kinds of bromeliads—the festooned Florida-moss (*Dendropogon usneoides*) and the small bristly wild-pine (*Tillandsia tenuifolia*). We reached the middle of the peninsula just as darkness fell. The thermometer was also falling and the air soon became uncomfortably cold. However, we put down all the curtains of the car and made a dash for the eastern coast, covering country described in a former paper,[1] and coming out at Melbourne on the Indian River just as the clock struck twelve (midnight).

Sunrise found us on our way down the eastern coast The notice of approaching spring, although by the formalities of the calendar the advent of winter was at hand, was given by the yellow bursting aments of the spruce-pine (*Pinus clausa*). Along the Indian River and Saint Lucie Sound the herbaceous vegetation of the sand-dunes ranged from almost nil to a copious growth of typical winter-bloomers, such as the golden-aster (*Chrysopsis graminifolia*) and snow-drift (*Thysanella robusta*). In the high pinelands two relics of the past season were ubiquitous; they were a white boneset (*Eupatorium jucundum*) and a golden-aster (*Chrysopsis Tracyi*). Four weeks later they had disappeared from the flora, not to be revived until the following summer. The woody covering of the shell-mounds near the mouths of creeks and rivers was often the typically West Indian shrub—*Dodonaea jamaicensis*—which seems to bear flowers and fruits nearly or quite the year round. It is widely distributed along the eastern coast, and naturally so, for its dispersal is accom-

[1] Journal of The New York Botanical Garden **24**: 32–33.

plished in two ways, by the wind which spreads broadcast its winged fruits and by birds which are fond of the seeds which are easily removed from the fragile-walled fruits. Near Jensen we came upon the large mallow (*Abutilon cordifolium*) that we found at Cedar Keys and at other localities mentioned above. This is the first record of the occurrence of that species on the eastern coast. Like the rattle-box (*Crotalaria Saltiana*), this species was naturalized on the western coast long before it became established on the eastern side of the state. South of the Saint Lucie River a little more color appeared in the landscape. The pinelands often showed areas of the purple false hound's-tongue (*Trilisa paniculata*) and the yellow sensitive-pea (*Chamaecrista brachiata*), while the green of the prairies, especially where water stood, was conspicuously interrupted by the violet-blue flowers of the pickerel-weed (*Pontederia cordata*), the rose-pink of the marsh-pink (*Sabbatia grandiflora*), and the greenish-yellow of the milkwort (*Polygala cymosa*).

We were soon in the great ancient sand-dunes in the vicinity of Hobe Sound. The typical arboreous growth of the sand-dunes, the spruce-pine (*Pinus clausa*), is gradually disappearing, but with progressive rapidity. It would seem that this typical "scrub" was not free from the invasion by fire in prehistoric times; no doubt it suffered from the fires started both by the thunderbolt and by the aborigines. With the invasion of the Seminole Indians it suffered more. Their activities and methods of the chase are historic matters. Lastly, the white man is outdoing all his predecessors in making the "scrub" a plant-association of the past and often a desert. The spruce-pine (*Pinus clausa*), like the other short-leaf pines, is not so resistant to fire as are the long-leaf pines. As a rule, after fire has swept over the "scrub" the area remains devoid of pine trees or one of the long-leaf pines invade it and replaces the former short-leaf kind. We have observed numerous examples of this phenomenon.

The spruce-pine, both in the coastal regions and on the interior dunes, always leans, usually decidedly so, away from the prevailing wind. It would seem that its root-system as anchorage is not equal to the strain of the wind on the tree. When a long-leaf pine tree replaces it or grows with it, the trees are strictly erect. It was noticed in several places in the "scrub" where

the Australian pine (*Casuarina equisetifolia*), a tree of course not related to the conifers, had been planted or had sprung up spontaneously, that the trees leaned away from the prevailing wind, just as those of the associated spruce-pines did, thus indicating an inadequate anchorage by the root system. In passing it may be of interest to note that the "scrub," with its scraggy shrubbery, its endemic genera, such as the rosemary (*Ceratiola*) and garberia (*Garberia*), its endemic species, too numerous to mention here, and its arboreous growth of nothing but the spruce-pine, is by far the most striking plant-association in the State. The association is unique. In a way it represents two very different plant-associations combined—hammock and pineland. The hammock growth, of course, is diminutive, shrubby, while the arboreous, consisting of pine trees, is relatively gigantic. In the midst of the "scrub" one has the sensation of being in quite a different world.

The most interesting unsolved question in connection with the "scrub" is: why does it exist? The soil—silvery white sand—of the scrub seems usually to be devoid of nourishment for plants, yet exotics often grow well, both where planted and where spontaneous. Two exceedingly interesting examples of woody plants used at least for ages to a diametrically different habitat were noticed in dooryards on the old dunes now naturally occupied by the "scrub." Trees of the sea-grape (*Coccolobis Uvifera*) and of the black mangrove (*Avicennia nitida*) set out in the dry sand were thriving just as they do in their normal habitat, which is in saline localities, where their roots are ordinarily bathed in salt water. It would be interesting to know if the red-mangrove would grow in such a habitat. We know it will grow in fresh water[1] far from the influence of salt, but will it grow in a dry habitat as well, as do its two ordinarily associated species just mentioned?

On the apex of the ancient dunes in the vicinity of Hobe—on the early maps "Jobe"—Sound we looked down on a remarkable crazy quilt. A half dozen colors in various shades were represented by either foliage or flowers, often in patches of pure growth, or, if mixed, one kind predominating sufficiently to give the decided color or shade. For example, there were the light green of the foliage of the tallow-wood (*Ximenia*), the deep

[1] Journal of The New York Botanical Garden **20**: 194.

green of the rosemary (*Ceratiola*), the yellow green of the woe-vine (*Cassytha*), the gray green of the saw-palmetto (*Serenoa*), the various shades of green of the several scrub-oaks (*Quercus*), the yellow of the heads of the yellow buttons (*Actinospermum*) and the golden-aster (*Chrysopsis*), and the pink of the knot-weed (*Thysanella*), and the white of the sand upon which all the above grow.

The cypress heads on the old sand-dunes south of Jupiter showed a remarkable development of the inland cocoa-plum (*Chrysobalanus pellocarpus*). The clumps of greenery, varying much in size, were particularly conspicuous on account of the different-aged leaves; those of the new shoots being tender and light-green, those of the persistent foliage leathery and dark-green. Observations on the palms on the coastal dunes from Palm Beach to Delray impressed us with the great superiority of the crown of the coconut-palm in strength as well as beauty. On the dunes from the barrier beach to where the scrubby vegetation sloped up and merged into that of the hammock of the lagoon, the leaves of the coconut were unscathed either from the whipping of the continuous coastal wind, particularly from the winds and salt spray of the recent hurricanes, while those of the royal palm and those of the native cabbage-tree and even of the saw-palmetto, showed the frayed and dead segments of the leaf-blades.

Evening found us in Miami, where we stopped long enough to establish our headquarters at the Plant Introduction Garden of the United States Department of Agriculture and the several reservations of Mr. Charles Deering, whose interest in the flora and floristics of Florida made possible the excursion here described. Then we continued on to the Cape Sable region. The prairies southwest of Royal Palm Hammock abounded in a peculiar aster. It grew in colonies—a hundred or more stems together sometimes. The stems were often six to eight feet tall and the leaves were dark-purple and the rays of the very numerous heads pale-purple.

We were soon in one of the departments of Dante's "Inferno." Had not Dante written his celebrated classic in pre-Columbian days, we would be constrained to believe that he had visited the Cape Sable region of Florida before he wrote the lines of the canto describing the lost souls appearing as scraggly trees. At a dis-

tance the growth of pond-cypress trees gives one the impression, on account of the pale bark against the darker backgrounds, of gigantic cobwebs, mists, or large patches of frost. A closer view of the thousands of individual diminutive trees in the winter season, compels the imagination to the idea that in these trees are collected all the mean, shrunken, and warped souls of the past inhabitants of civilized North America!

From Bay Biscayne to Key West

Having planned to devote a few days to the Florida Reef, we embarked on the "Barbee" late one afternoon and set out for the Lower Keys. It was to be a memorable cruise.

We anchored off Elliott's Key after sundown. The night was wonderful. The moon had come up. Above was enough wind to move the clouds into everchanging scenery. Below was a dead calm. Although the hull of our boat really stood only two or three feet out of the water, in looking down it seemed to stand twelve or fifteen feet up, the clearness of the water and the smoothness of the surface combining to produce the optical illusion. All objects on the light sandy bottom were plainly visible, while the moon was up. After the moon went down a pole thrust to the bottom would scatter fire in all directions, due to the phosphorescence of the various small aquatic animals. Dawn and forenoon maintained the perfect calm. The water's surface was as smooth as a mirror. The clouds by day, as they had been by night, were so perfectly mirrored that it seemed we had the same clouds beneath us as above. Wonderful overhanging panoramas were presented on the bottoms of the bays, creeks and sounds. According to the lack of marine vegetation or the presence of it there were submarine deserts or lawns and fields and forests, and gardens. The bottom was flat or undulating; even mounds existed where the roots and rootstocks of turtle-grass (*Thalassia*) held the sand firmly. Where vegetation was wanting, the sand was often scooped out into deep valleys. Besides the submarine fields of turtle-grass there were lawns of manatee-grass (*Cymodocea*) and of halodule. The various kinds of crabs made burrows in the sandy bottoms that simulated the gopher-holes of the land. Of course, seaweeds of the several categories were much in evidence, and there were often great diminutive forests of the tufted merman's shaving-brushes

(*Penicillus* sp.), and of the mermaid's wine-glasses (*Acetabulum* sp.). The waters were often teeming with animals ranging from the lowliest to the highest groups. There were the gay corallines and the dingy sponges of all sizes and shapes, both firmly anchored to the bottom. The moving kinds most in evidence were crustaceans, of which the crayfish is the most fantastic and ornate, then fish, and even the elusive sea-cow.

The hammocks bordering Steamboat Creek, a natural canal cutting off a spur of Key Largo, presented mangrove trees of endless fantastic shapes. Red-mangrove (*Rhizophora*) and black-mangrove (*Avicennia*) are the dominant or exclusive trees. Although closely associated and growing under exactly the same influences, the red-mangrove has dependent aërial roots, pale trunk, and light green foliage; the black-mangrove has erect aërial roots (pneumatophores), dark trunk, and dark-green foliage. The submarine panorama and aquarium were continued all day. Towards evening the weather conditions changed. Clouds formed extensively and the sunset was gorgeous. In the west and south quarters of the sky were green clouds lined with gold; in the east and north were gray and blue clouds that merged into pink and red, and all was so perfectly merged with the water that no horizon was discernible. Before midnight we ran in behind some rocks near the lower end of Vaca Key for the night. Dawn showed us that these were the same rocks we anchored behind three years previous. As soon as we got under way the weather became squally. Dark clouds with paler tinted edges in the east were piled up to simulate cliffs and landslides. In the west the clouds were dispersed in an aurora-borealis effect. From the main mass dark detached portions would begin to pour down as rain and disappear until the sky was nearly cloudless, when we observed a double rainbow, and in a short time ran through a shower falling from a clear sky.

The "Barbee" had thus far plowed waters varying from deep-indigo to pale limpid-green, the various shades depending upon the depth of the water, the character of the bottom, and the cloud-effects. A number of times those old ecclesiastical verses, "where every prospect pleases, and only man is vile," were brought to mind by the sight of empty cans and bottles nestling discordantly among the corals, sea-feathers and sponges! With the freshening of the wind the water of the shallower places

became milky-white as a result of the disturbing of the marly bottom.

We were not long in reaching the largest and, botanically, the most interesting of the lower keys, namely Big Pine Key. This island has been yielding botanical treasures for nearly a century and the supply is not yet exhausted. Upon arriving off the eastern shore, we disembarked, went half way up the middle of the island, and thence to the western shore. The higher parts of the key support a very remarkable growth of palms. The silver-palm (*Coccothrinax argentea*) and the thatch-palm (*Thrinax microcarpa*) intermingle in an amazing manner. The port of each is quite distinctive. The crown of the former is soft and graceful, while that of the latter is harsh and stiff. The growth of these palms is more remarkable when we stop to consider the habitat. This is a more or less plate-like condition of the oölitic limestone devoid of soil. The palms are practically epipetric. The palm-trunk arises either from a mound of roots placed directly on the flat rock or often it emerges from a circular erosion hole which it nearly or quite fills.

While going up through the pine-palm lands there was much to attract the attention, at least among woody or partly woody plants. The tamarind (*Tamarindus indica*) was naturalized in several places. The Bahamian-senna (*Cassia bahamensis*), with its clusters of yellow flowers, grew higher than one's head. Two plants often filled the air with their fragrance. The homely tropical semi-weed capraria (*Capraria biflora*) gave off a fragrance suggesting that of the lily-of-the-valley. The yellow opoponax (*Vachellia Farnesiana*), conspicuous not only on account of its myriads of yellow flowers but also on account of its numerous white spines, was often almost overpowering with its violet-like fragrance, which can often be detected further than the shrub can be seen.

Big Pine Key presents great variety in physical conditions and in plant associations. Each excursion discovers novelties. In crossing from the center of the island to the western coast, we came upon a low prairie-like area. One of the first objects to attract our attention was a West Indian shrub (*Strumpfia maritima*). Ordinarily it is tall, but there it grew only about one foot high. It was flowering and fruiting; both the flowers and fruits are white and about equal in size, about a sixteenth

of an inch long. That is evidently one of the localities visited by J. L. Blodgett[1] about eighty years ago, and not since visited, for *Strumpfia*, which apparently grows nowhere else on the island, had not since been collected there. We next entered a Lilliputian forest of Spanish stopper (*Eugenia buxifolia*); the trees were rather closely placed and varied from three to four feet tall. Other surprises presented themselves before we reached the western shore. Not so much in the kinds of the plants, but in their habits. Woody plants, often trees,—the locust-berry (*Byrsonima lucida*), buttonwood (*Conocarpus erecta*), joe-wood (*Jacquinia keyensis*), saffron-plum (*Bumelia angustifolia*), and indigo-berry (*Randia aculeata*)—instead of growing erect and large, all grew as depressed shrubs, often even prostrate on the rock or marl of the prairie.

It was late in the day when we reached the hammocks bordering Big Pine Channel about midway between the northern and southern ends of the body of the island. Our way bristled with thorns or spines. In addition to copious growths of armed prickly-pears (*Opuntia Dillenii* and *O. zebrina*), by which we were often forced to make detours, armed shrubs such as saffron-plum (*Bumelia angustifolia*), yellow-opoponax (*Vachellia Farnesiana*), and tallow-wood (*Ximenia americana*) successfully blocked our direct progress. On the edge of one hammock we found the snowberry (*Chiococca*) growing as a shrub instead of a vine. Similar and larger specimens with this habit were found several years ago on Elliott's Key. Then our goal was unexpectedly reached—a hammock made up largely of trees of cupania (*Cupania glabra*).[2] This West Indian plant was collected on Big Pine Key eighty-odd years ago by J. L. Blodgett, perhaps at the same time he found the *Strumpfia*, mentioned above. We had been searching Big Pine unsuccessfully, however, for it for more than a decade. Thus, one after an other, the rare plants found on the lower keys by J. L. Blodgett in the earlier part of the last century, yet thrown out of our flora by the doubting Thomases, are coming to light again. The genus

[1] For a biographical note, see Journal of The New York Botanical Garden **22**: 51.

[2] The actual rediscovery of this tree in Florida should be credited to Charles T. Simpson who found it in another hammock on the western side of Big Pine a few weeks before our visit to the island.

Clusia, collected on that key long ago, remains to be found again. Epiphytic orchids were, apparently, absent from those hammocks, but some wild-pines (*Tillandsia*) were present.

As we crossed back to the pinelands the sun shone horizontally through the trees. The satin-leaf trees (*Chrysophyllum oliviaeforme*), often rising above the other trees of the hammocks we had just left, with their leaves turned up by the breezes, appeared like great masses of flame. The foliage in the pine-palm land was striking under the horizontal rays of the sun. The yellow-green of the thatch-palm (*Thrinax*) and the deep-green of the silver-palm (*Coccothrinax*), more than ordinarily lively on account of the prismatic effect of the plaited leaf-blades, all overtopped by the soft green of the pines (*Pinus caribaea*) in fantastic pattern against the blue sky, was a wonderful sight, perhaps unique, for nowhere else in the country is there a similar growth of conifers and palms. Although there were no orchids in the hammocks we did find two terrestrial ones among the palms. The one, the tall bletia (*Bletia purpurea*) with bright-purple flowers, the other, the low rein-orchid (*Habenaria quinqueseta*), with smaller greenish-white flowers.

The following morning we dropped down No Name Channel about a mile and went ashore on the southern extension, the later geological accretion (coral) to the original (oölitic) Big Pine Key. On the wide marly plain between the water and the hammock we crossed patches of prostrate vegetation showing all shades of green from the very pale to the very dark, among them saltwort (*Batis*), beach-carpet (*Philoxerus*), sea-purslane (*Sesuvium*), big carpetweed (*Trianthema*), and some red-samphire (*Salicornia*). The tissues of these plants were so turgid with water that they crunched as so much glass when we stepped on them. On the edge of the hammock the air was charged with compound fragrance. The decided odors of the mosquito-plant (*Ocimum*), the saffron-plum (*Bumelia*), and the torchwood (*Amyris*) were variously blended.

The novelty yielded by this plain-hammock borderland was a prickly-pear of uncertain relationships. It is an erect plant, with long gray spines at maturity. The young spines are bright-yellow—a combination unique among our native prickly-pears. This yellow to gray spine character is new to our flora. Neither flowers nor fruits were secured, but plants were introduced in

our cactus plantation at Buena Vista, where they can be studied at leisure.[1] Further studies were made on the new prostrate prickly-pear discovered there a year before. Its flowers have not yet been seen, but the fruits were secured again and showed the same urceolate and tuberculate character indicated by those found in limited quantities before.[2]

This borderland supports a flora quite different from that of the adjoining parts of the island, particularly in the small, often very delicate kinds of plants.

The plain mentioned above has a rock foundation which is mostly covered with marl, hence there is only a limited plant-covering. The hammock occupies the higher rock formation upon which humus has accumulated from the decay of the plant-covering. On the borderland a mixture of sand and humus has accumulated on the flat rock, and here we find a much varied plant-association. Leaving out of consideration at this time the taller herbs and the shrubs, there are more than a dozen rather diminutive plants that often do not grow to be an inch tall, but are more or less spread out and intimately associated or developed as pure colonies. Among these may be mentioned the lace-plant (*Pilea microphylla*), whose English name is suggested by the lace-like patterns formed by dichotomous stems and the small (sixteenth of an inch) round leaves. There are two portulacas (*Portulaca*), one with flat-leaves and one with cylindric leaves, but both with small yellow flowers. Our smallest galingale (*Cyperus squarrosus*), with licorice-scented foliage and numerous spikelets each resembling a diminutive centipede, was much in evidence at that time of the year. A morning-glory relative (*Evolvulus alsinoides*) made up in spread where it lacked in height. Stems and branches a meter or two long radiated from a central root and in the leaf-axils supported erect pale-violet or lavender saucer-shaped flowers about a quarter of an inch wide, and so the list might be continued.

Within the dense hammock few herbaceous plants were noticed. The broad-leaved or "hardwood" trees are naturally thickly placed. Hardwood applies well in this case, for most

[1] Since described as *Opuntia ochrocentra* Small; Britton & Rose, The Cactaceae **4**: 262. 1923.

[2] Since described as *Opuntia abjecta* Small; Britton & Rose, The Cactaceae **4**: 257. 1923.

of the kinds growing as they do on solid rock and in scant humus increase in size slowly and make very firm tissue. This condition is conducive to the growth of the lichens which abound there. However, there are few epiphytic flowering plants in the hammock. One tree-orchid (*Encyclia tampensis*) and several wild-pines (*Tillandsia*) constitute that kind of growth. Although there is water on all sides, the continuous winds render the air too dry to permit of much epiphytic growth of the higher plants.

The semi-desert conditions in the hammock are indicated by the remarkable cactus-development which has already been described.[1] The giant West Indian prickly-pear (*Opuntia Dillenii*), the dildoe (*Acanthocereus pentagonus*), the impenetrable thickets of the prickly-apple (*Harrisia Simpsonii*), and the massive tree-cacti (*Cephalocereus Deeringii* and *C. keyensis*), all seemed more viciously armed than ever before. The tree-cacti just mentioned might be called trees of water. We found trees that perhaps weighed more than a ton, yet they represent just so much water contained in a delicate tissue which is held up by a slight woody skeleton that is a mere fraction of the weight of the tree.

Some of the basin-like pools were framed in blue by the myriad flower-heads of the wild ageratum (*Ageratum littorale*). This growth was sometimes augmented by masses of other blue flowers of the tropical bindweed (*Jacquemontia pentantha*) and of false-verbena (*Valerianoides jamaicensis*).

The wild-coffee (*Colubrina Colubrina*) was noticed in a new role—a fireweed. Where charcoal burners had left their trail this tree had sprung up and grown to the height of six or eight feet with the stems thickly placed and most of them bearing flowers and fruits.

As in the case of the tin cans and glass bottles on the bottom of the bay mentioned above, we could tell that civilized man had been on that part of the island before us, for three naturalized exotics were found in profusion as we returned to the "Barbee" —the tomato (*Lycopersicon*), the garden-lettuce (*Lactuca*), and the sow-thistle (*Sonchus*).

After the day was well spent we headed the "Barbee" for the return trip. Our success in discoveries and rediscoveries on Big Pine Key determined us to spend a day on Key West, that

[1] Journal of The New York Botanical Garden **22**: 49–55.

is, among the remnants of the remarkable plant-covering that once grew there. Consequently we anchored off Vaca Key that night. In the morning we went ashore and boarded the "Over-sea Limited" and were soon in Key West. In the meantime Captain Matthaus took the "Barbee" as far east as Long Key where we overtook her during the following night.

En route we were impressed by our lack of knowledge of the flora of the lower Florida Keys. That group of islands is largely virgin botanical territory. Only the most prominent vegetation of the higher land was in evidence from the train. The palm growth is the striking feature. There are great colonies of different kinds of palms on different keys. Thatch-palms, silver-palms, saw-palmettos, and cabbage-trees were plentiful. It was on Cudjoe Key that we first discovered the cabbage-tree on the lower keys several years ago.[1] The exact geographic distribution of the palms on the lower keys would make an interesting study.

The day on Key West was spent in tramping every street in town studying the cultivated plants and collecting in the vacant lots among the native and naturalized plants. The last bit of the original forest had disappeared since our latest visit, and with it the last fine specimens of the Key tree-cactus (*Cephalocereus keyensis*). Although several kinds of exotic cacti are cultivated in the front yards of Key West, no one has been interested enough in the native flora to rescue the large tree-cactus of the island from extermination, at least our examination revealed none except one diminutive specimen planted on a grave in the cemetery. The cemetery, in fact, is the botanical garden of the city. There are many exotics grown there, but scarcely a half dozen native trees are to be seen. A few trees—pigeon-plum (*Coccolobis laurifolia*), gumbo-limbo (*Elaphrium Simaruba*), strongback (*Borreria havanensis*), ginger-tree (*Sebestan Sebestina*) and redbug-tree (*Solanum bahamense*)—are the only relics of the one-time hammock.

While studying in the cemetery we settled the question as to whether pine-trees (*Pinus*) once grew on Key West in recent times, as had been affirmed by some and denied by others. Inquiries made of the sexton who had known the cemetery for sixty years brought out the information that he had cut down the last group of pine trees two or three months previous to our

[1] Journal of The New York Botanical Garden **12**: 155.

visit. He said, however, that we would find two pine trees in a lot five blocks north and two blocks east of the cemetery. We investigated and found the "pine-trees." They were not conifers, however, but Australian pines (*Casuarina equisetifolia*). The only remains of the arboreous part of the old hammock once existent in the heart of the city where occasional trees of the Jamaica dogwood (*Ichthyomethia Piscipula*), tallow-wood (*Ximenia americana*), blolly (*Torrubia longifolia*) and two kinds of stopper (*Eugenia*). Stopper is the most abundant woody plant on the island; three kinds—Spanish-stopper (*Eugenia buxifolia*), white-stopper (*E. axillaris*), and red-stopper (*E. procera*) often cover wide areas, largely to the exclusion of other vegetation. The plants, however, are low and suggest a second growth.

Many interesting herbaceous plants were collected. The mosquito-plant (*Ocimum micranthum*) was in flower, and the differences between it and the one we found on the shell-midden near the mouth of the Suwanee were emphasized.

Rediscoveries were some of the rewards of the day: the African rubber-plant (*Cryptostegia grandiflora*) and the East Indian spurge (*Euphorbia lactea*), first found in Florida on Key West several years ago, were rediscovered in new localities. However, the noteworthy rediscovery was the means of solving one of the Blodgett mysteries, just as we had done on Big Pine Key. A single specimen of *Xylophylla* collected on Key West some eighty years ago by J. L. Blodgett was, up to the time of our visit here described, all there was to show that the plant really grew on Key West, and consequently within the limits of the continental United States. Botanists, with one exception, as in the cases of many of Blodgett's specimens, refused to admit it to our flora. However, on this occasion we rediscovered the spurge as an almost defunct plant near the edge of a hammock that is fast retreating before the improvements of man, and also in a front yard towards the outskirts of the city. Things animal, as well as botanical, were scrutinized. Lizards, toads, and snakes were captured whenever encountered, and assembled in the largest restaurant in town to await our departure in the evening. This course was perfectly safe, as prohibition had been in force there by local option long before the passage of the Eighteenth Amendment. However, towards the close of our day's wandering, we met a white cat on one of the side streets.

No amount of observation enabled us to decide whether it was a blond or a brunette, for although it's fur was white it had a *blue* right eye and the left eye was *brown!*

The following morning we spent a few hours on the eastern end of Long Key. We landed at the head of the large bay made by the two prongs of the fork at the eastern end of the island. After breaking through the mangroves and the adjoining hammock, we came out on a marly prairie resembling a great athletic field. On the edge of this prairie we encountered another dilemma almost as perplexing as that of the cat just referred to. All the buttonwood (*Conocarpus erecta*) thereabout was the variety with densely white-silky foliage. At first sight the leaves appeared to be upside down, perhaps they were placed there by a twist in the petiole. A close examination showed them to be structurally upside down, in so far as the petiole was flat below and rounded above, while the veins of the blade were prominent above and impressed beneath!

The early afternoon was spent in the hammock of Lignum-Vitae Key studying lignum-vitae (*Guaiacum sanctum*), snowberry (*Chiococca*), wild-coffee (*Psychotria*), and century plants (*Agave*).

Once under way after leaving Lignum-Vitae Key, we ran continuously, and in spite of getting lost once, after dark, by running four miles out of our proper course, we tied up to a dock at the mouth of the Miami River at two o'clock in the morning.

From Cape Sable to Ice and Snow

A second excursion to the Cape Sable region did not fail to discover plants and vegetation of interest. Thence we worked our way northward by irregular stages. So far, all our knowledge of the flora of the Cape Sable region is the result of a mere "scratching of the surface," so to speak. Although that region is now desolate and uninhabited, it was once the scene of considerable aboriginal activities. There are Indian mounds, for example, at the head of Shark River, between Middle and East Cape, on Little Sable Creek and back of Flamingo. A mound on Shark River is filled with skeletons of the sea-cow or manatee. The soil of this mound is evidently rich, for it is said some one planted a seed of an avocado (*Persea*) there and in four years it grew into a tree with a trunk eight inches in diam-

eter. In addition to the twin mounds back of Flamingo, there is an aboriginal canal connecting Mud Lake with the Bay of Florida. During the ages since it was excavated or was in use, it has become largely filled in, but in the shallower places the bottom never becomes wholly dry. This now abandoned channel once made the Cape Sable region an island. By means of it the aborigines could travel from the southern part of the Ten Thousand Islands to Mud Lake and through their canal to the Bay of Florida without going into the exposed and frequently rough waters of the Gulf of Mexico. We have often wondered if the canals connecting the chain of lakes, whose floristics we described in a former paper,[1] just east of the region under consideration, were not of aboriginal origin. We plan to examine the floristics of all these aboriginal monuments.

The Cape Sable region is one of strong contrasts in regard to plant-associations. Of course, there is the maritime part with all its variations; away from the sea there are extensive prairies where the land is flat, with high hammocks on the more elevated parts and swamps with low hammocks in the depressions. Low in this case refers to the elevation of the land, not to the height of the trees, for the mangroves which comprise the bulk of the hammock are often tall. The red-mangrove (*Rhizophora Mangle*), white-mangrove (*Laguncularia racemosa*), black-mangrove (*Avicennia nitida*), and button mangrove (*Conocarpus erecta*) grow intimately intermixed. The latter tree forms an erect or prostrate trunk, or sometimes grows after the manner of the pop-ash (*Fraxinus*), *i.e.*, with several or many trunks in a cluster.[2] These trees are often associated with vast ferneries, comprising the leather-fern (*Acrostichum aureum*), swamp-bracken (*Blechnum serrulatum*), and on the trees themselves the strap-fern (*Campyloneurum Phyllitidis*). The only herbaceous plants in bloom in the wet hammocks were two kinds of wild-pepper plants—*Peperomia obtusifolia* and *P humilis*. Popularly, these would not be considered as "flowers," for each flower consists merely of two minute stamens and a minute pistil, all discernible in detail only under a strong lens. Up to the time of writing these notes, five different kinds of wild peppers, com-

[1] Journal of The New York Botanical Garden **17**: 189-202. The Cape Sable Region of Florida 11.

[2] Journal of The New York Botanical Garden **22**: 61-62.

prising three natural groups, have been found native to the mainland of Florida. Two of the species pair respectively with the two mentioned above, and one stands off alone. Although they are related to our widely distributed lizard's-tail (*Saururus cernuus*), they are quite different from any other plants in our flora and they are individually and collectively so characteristic that they are especially attractive to all who are unacquainted with tropical floristics.

In the region of the wild-pepper we discovered another plant not so odd in habit and in structure as the wild-pepper, but quite different from anything previously found this side of the Gulf Stream. It is a mallow. with the euphonious generic name *Kosteletzkya*.[1] The branching plants grow as tall as one's head or higher and bear numerous white mallow-like flowers only about the size of the diameter of a dime. The interest, however, in the plant is largely tangible, *i.e.*, it is armed with stinging hairs after the manner of a nettle. Where the ground was slightly elevated in the brackish district, especially where the sun had access, the various native ground covers were rampant. The six principal kinds -samphire (*Salicornia*), amaranth (*Alternanthera*), beach-carpet (*Philoxerus*), saltwort (*Batis*), sea-purslane (*Sesuvium*), and mud-carpet (*Bramia*)—might be termed pioneer or temporary plants, for they are the first to cover newly made or recently disturbed soil, and by their growth and decay pave the way for other plants to take their places.

The woody monocotyledons of the low country were three palms: two of our very common and wide-spread kinds—saw-palmetto (*Serenoa*) with prostrate trunks, and cabbage-tree (*Sabal*) with erect trunks, and one of our rarer species, the saw-cabbage palm (*Paurotis*). The two former may grow isolated or in groups, but each stem is a unit. The latter, however, is gregarious. For some reason, it has developed an underground stem-system resembling that of a couch-grass (*Agropyron repens*), only on a gigantic scale. Therefore, the trunks, which are really erect branches arising from the underground stems, are secondary and not primary, as are the trunks of the two other palms mentioned above. The saw-cabbage palm, therefore, in its growth, simulates a perennial grass, but in a gigantic scale. The number of stems (branches) of an individual plant vary from a dozen or less to a hundred or more.

[1] *Kosteletzkya pentasperma* of the West Indies.

In hammock back of Cape Sable, Florida. Struggle between a cabbage-tree (*Sabal Palmetto*) and a strangling-fig (*Ficus aurea*). The cabbage-tree is doomed Has the fig intelligence? It has thrown both legs and arms securely about the cabbage-trunk. In the struggle the crown of the palm has pushed away the head of the strangling monster; but the latter has thrown down a strong prop to brace it against further repulsion Some years hence the fig, having conquered, will stand alone as a large forest tree.

Every specimen of a cabbage-tree (*Sabal Palmetto*) with a well-developed trunk that we noticed in the Cape Sable region was burdened with a strangling-fig (*Ficus aurea*). This condition means that after a cabbage-tree dies, either naturally or as a result of being "choked" by a strangler, a fig-tree will stand in its stead.

There was, quite naturally, a greater variety of woody vegetation on the higher ground of the region. Among the trees, stoppers (*Eugeniae*) and the butterbough (*Exothea*), the mahogany or Madeira-redwood (*Swietenia*) and the manchineel (*Hippomane*) stood out conspicuously. Both the mahogany and the manchineel once grew in the Brickell hammock at Miami, but they have now disappeared. One tree of the manchineel survives in the Deering hammock at Cutler.

Two grape vines, cousins as it were, neither true grapes, however, met and mingled in the hammocks of the Cape Sable region -the tropical grape (*Cissus sicyoides*) and the temperate Virginia-creeper (*Parthenocissus quinquefolia*). Other vines were present, but less conspicuous under normal conditions. However, where the hammocks were burned, the vines came into their own. The ashes resulting from the fire stimulated their perennial roots and the sunlight reaching to the ground brought about a complete covering of the ground and the tree-skeletons. Two morning-glories—the coastal morning-glory (*Ipomoea cathartica*) and the moon-flowers (*Calonyction aculeatum* and *C. Tuba*)—were the chief decorators of the wrecked hammock, although several other vines were present, for instance: other morning-glories (*Ipomoea*), milkweeds (*Philabertella*), dogbanes (*Rhabdadenia*), wild-cucumbers (*Melothria*), hemp-vine (*Mikania*), and so on. One of the more important discoveries in the Cape Sable region was the key form of the snowberry (*Chiococca* sp.?). It seems to be different from the two other kinds inhabiting the peninsula—*Chiococca alba* and *C. pinetorum*—the former rather widely distributed in hammocks except in the northern part of the peninsula, the latter restricted to the pinelands of the Everglade Keys.

On the prairies supported by the Lossman's River limestone the gregarious shrub was the red-mangrove (*Rhizophora Mangle*). The plant never reached the size or port of a tree, as it does in the swamps a few miles further south. The red-mangrove is a

halophyte and will grow luxuriantly in salt water; but it makes its most noteworthy development where it gets a certain mixture of fresh water and salt. Consequently, it is on the edge of the delta of the Everglades, namely, the Ten Thousand Islands and along Bay Biscayne on the opposite side of the peninsula, where there is a great deal of seepage of fresh water from the Everglades that we find, perhaps, the most wonderful growth of the red-mangrove in existence. The manner of the combination and the percentage of fresh water and salt water, and the methods of the natural feeding of the solution to the mangrove roots would be an interesting problem for some ecologist to study and perhaps to solve.

As intimated above, the mangrove on these Everglade prairies does not grow large; in fact, the plants are quite stunted. In places they suggest to the observer herds, as it were, of hundreds or thousands of gigantic, uncanny gray crabs of some kind—their skinny bodies, the main stems, supported on slender bowed legs, the aërial anchor roots. As in the case of the pond-cypress which replaces the mangrove on the oölitic limestone, the bark of the mangrove is conspicuously gray. This region would have delighted Dante in that it would have awakened ideas for filling out his Inferno.

The horizontal rays of the setting sun transformed the prairies into an array of many shades of green, altogether a picture of great tranquillity. It was a picture of vegetation, the extreme light green of the open prairie being the general background on which the darker green of the hammock islands was set. In addition to the greens, there was the low-drifted gray smoke, as it seemed, caused by the distant colonies of the dwarf leafless pond-cypress. The picture represented absolute rest, except for an occasional flock of day-feeding birds returning from the coastal regions northward to their hammock rookeries as a part of their daily routine.

For mile after mile the air of the prairie was delightfully scented with the fragrance of the tropical buckthorn (*Bumelia angustifolia*) which was in bloom in many of the hammock islands which dot the prairie.

In passing, it may be of interest to note that the development of the numerous hammock islands just referred to is one of the several fundamental unsolved questions of the Cape Sable region

of southern Florida. Up on the higher oölite we found a trinity of dry-land ferns, a counterpart, as it were, of the trinity of the wet-land ferns we had found on the Lossman's River limestone. Curiously enough, these three ferns are closely related, the older botanists and even some of the "conservative" modern ones would classify them in one genus. As we understand them, they are the brake (*Pteris caudata*) with tall, even, vine-like leaves, with ample compoundly pinnate blades; the pineland-bracken (*Pycnadoria pinetorum*), with erect more or less clustered leaves with simply pinnately compound blades, and the birdnest-fern (*Pycnadoria longifolia*) with radially prostrate or incurved leaves with simply pinnately compound blades, which are somewhat similar to those of the next preceding species, but with the leaflets more auricled at the base and the whole plant rough-hairy.

Since our last excursion through that region the entire hammock area on the bay at Cutler has come into the possession of Mr. Charles Deering, who will preserve it in its natural state. This is the only hammock of the Everglade Keys or in tropical Florida that has not been seriously or fatally injured. Mr. Deering's reservation is an ideal natural botanical garden. It has all the conditions required by plants in that part of the country. There is a large island in the bay, Chicken Key, with both highland and lowland; there is the bay itself inhabited by marine aquatics, there is the mainland shore with its marshes, mangrove-swamps, and low hammock. The low marly front rises into a rocky plateau which is more or less eroded, so as to furnish conditions from permanent water to barren rocks.[1] There are several tidal creeks connecting with the bay, and a fresh-water stream runs from a prairie in the western part of the reservation to the bay. The western side of the reservation or that away from the bay is high pineland, in fact the great hammock is surrounded by pinelands except where it meets the bay. To describe the plant life of this reservation would require more space than a paper of this kind occupies. Suffice it to say here that the vast majority of the hammock and pineland plants of the Everglade Keys grow there naturally and Mr. Deering has started to introduce the desiderata.

[1] The peculiar erosion in this hammock was described in the Journal of The New York Botanical Garden **22**: 193 222. 1921.

Already several more or less barren places have been planted. A small hammock has been successfully made with rare trees transplanted from the Brickell hammock in Miami. It contains many specimens of the rare sassafras-relative—*Misanteca triandra*. A date-palm plantation has been set out in the prairie and a century-plant garden has been established, all in ideal places and the plants are growing well. Other plantings have been made, but the above are the main features at present. Several botanical experiments are well under way and specimens of zamia from various Florida localities have been introduced for the purpose of comparing the different species[1] in a study of these primeval plants.

The regions now known as Cutler and Miami are the southern and the northern limits, respectively, of about eighteen miles of coastline different from any of the other coastline of North America. It is where the eastern extremities of a series of limestone islands—Everglade Keys—once evidently marine, reach the salt-water, but which at one time when the land was less elevated were surrounded by the sea. Today they might be termed semi-islands, for during the rainy season they are surrounded with the waters of the Everglades in which they are now situated, except for the coastal portion just referred to, while in the dry season they are just as sharply differentiated by the dry marl of the Everglades. This region was evidently a place of especial aboriginal activities. At the time of the late prehistoric aborigines or their ancestors, these islands may have been vast hammocks instead of pinelands, as they are now, and doubtless abounding in animal life different from or more abundant than that in other parts of the peninsula. At any rate, we have inherited them "labeled" on one hand "hunting grounds," an indication that the region was a rendezvous for the securing of meat, and, on the other, "Koontee grounds," also an indication that the aborigines there secured their needed supply of starch or coontie from the stems of the zamia,[2] which grew there in astonishing abundance.

The Seminoles, like the aborigines, drew on this region to supply their wants, both of animal and vegetable foods. The

[1] For other mention of the Deering hammock, see Journal of The New York Botanical Garden **22**: 217-218.

[2] See Journal of The New York Botanical Garden **22**: 121 137.

white man soon followed, and with his greater activity and more effective weapons and tools has exterminated the animal life and is doing all in his power to exterminate the vegetable, both through carelessness and sheer wanton delight in seeing all things material disappear, and that quickly.

There are several aboriginal burial mounds in the Deering hammock. Their arboreous growth is peculiar. The many live-oaks (*Quercus virginiana*) of the hammock are often of the form with short trunks with many long widely spreading branches. The oaks on the Indian burial mounds, however, have tall shaft-like trunks with fewer branches much more distant from the ground.

It seems that the southern limit of the "scrub" on the eastern coast is just west of Lemon City, between three and four miles north of Miami. The characteristic plant-association was there, except the spruce-pine (*Pinus clausa*) which, however, was reported from that region not many years ago. The rosemary (*Ceratiola*), tallow-wood (*Ximenia*), dwarf wax-myrtle (*Cercthamnus*), scrub-oaks (*Quercus myrtifolia, Q. Chapmanii*), wild buckwheat (*Polygonella*), knot-plume (*Thysanella*), and little-clubmoss (*Selaginella*) were all in evidence.

The plants of the "scrub" anywhere are small-leaved—both the herbaceous and the woody vegetation. Take, for example, some of the characteristic plants. Those with very numerous leaves have them very small and crowded. This condition is well illustrated by the little clubmoss (*Selaginella*), pinweed (*Lechea*), and rosemary (*Ceratiola*). Plants with few leaves have them remote and larger; for example, the scrub-oaks (*Quercus*), tallow-wood (*Ximenia*), wild buckwheat (*Polygonella*), and knot-plume (*Thysanella*). A few plants show both conditions on the same individual. Thus in the heath (*Xolisma fruticosa*) the few remote large leaves on a main stem are abruptly replaced by many smaller closer-set leaves on the branches.

The sun had set when we bid farewell to the Everglade Keys and started northward. We drove about fourteen miles along the beach—a tantalizing ride at night, for the vegetation thereabouts always yields something interesting and instructive. Physiographically, it is noteworthy in being the southern extreme of the series of coastal peninsulas and islands which have their northern extremity at Cape Cod. However, the flora of the

eastern Massachusetts dunes is boreal and temperate, while that of the southern Florida dunes is tropical and subtropical.

North of Arch Creek we went inland to the Dixie Highway, and sunrise found us about half way up the peninsula. We crossed the lagoon or sound, here called the Indian River, at Melbourne. This was the first time these dunes were easily accessible. However, there were few trails, as yet, by which to investigate the flora. The dunes on the sound, western side, are clothed with "scrub" with the typical spruce-pine (*Pinus clausa*), the prominent tree. The dunes on the ocean, eastern side, are clothed with the low treeless dune vegetation, with the scrub-oaks (*Quercus*) in some places only a foot tall or even less. The low sand-rollers comprising the dunes were somewhat flower-adorned, even if it were winter. Blue-curls (*Trichostema dichotomum*), verbena (*Verbena maritima*), pinweed (*Lechea racemulosa?*), lupine (*Lupinus villosus*), wild sensitive plant (*Chamaecrista brachiata*), golden-rod (*Solidago Chapmanii*), a New Jersey tea (*Ceanothus microphyllus*), were all in bloom. However, a wild-potato or nightshade (*Solanum gracile*) was the most noteworthy plant. It was branched at the base and the branches either trailed on the ground or twined on the adjacent herbs or shrubs. Its star-like corollas were pale-purple and measured about a half inch in diameter. A few miles further north brought us into the latitude of the Cape Canaveral region. The Cape and the adjacent insular territory is still a botanical *terra incognita.* It is here that the coquina formation comes close to the surface of the land or is exposed. It may be this geologic condition that is responsible for the existence of the Cape. The coquina itself, or with a thin covering of sand on the mainland adjacent to the Indian River, supports a wonderful hammock and growth of cabbage-trees (*Sabal Palmetto*). North and south of this coquina exposure or where the coquina is buried deep beneath the sand, we find extensive associations of "scrub."

The physiographic formation of the upper Indian River and the Halifax River and the consequent movements of the tides was and still is conducive to a copious growth of oysters. There the prehistoric red man built up many remarkable monuments. Like the coquina, which, however, is composed of very small shells of mollusks, these aboriginal monuments—kitchen-

middens—consist of the shells of larger mollusks, such as the oyster, the clam, and the conch. Each state in the Union has its disgraces—several or more. Florida has to its shame, among other sins of commission, the wholesale destruction of its natural unique monuments of various kinds. These shell-mounds that evidently took scores of generations to build are being destroyed by the State itself within the space of a few generations, namely, for securing road material. Little did the ancient aborigines think while building up these giant heaps of shells that they were contributing to the great wide trails of their ultimate successors!

Apart from what has been written above about the plant covering peculiar to these shell-mounds, the make-up of this plant-association and the reasons for it will be discussed in a future paper. Suffice it to say here that with the turning of the middens into roads, the position of the mounds themselves and their plant-covering will be lost, unless we get an accurate record of both while there is still something of the original monuments left to study.

That the climatic conditions about the shell-mounds are tempered by the proximity of the ocean and the physiography, is shown by the natural plant-covering and by the various tender plants cultivated in the towns that have sprung up there. This tempered climate, at least in part, is responsible for the urban development of Daytona and the neighboring settlements. It may have been partly responsible for the former aboriginal settlements thereabouts.

The coastal sand-dunes north of the Cape Canaveral region are wonderful. They, together with their vegetation, like the kitchen-middens, are fast disappearing before the onslaught of the white-man's civilization. Consequently, in the Daytona region one finds dunes either in their primeval virgin condition or ravaged by fire, and consequently unsightly, or with even the sand moved, the areas graded and under a high state of formal cultivation.

The guava (*Psidium*) was found naturalized and hardy in many places on the dunes. This in itself speaks in favor of a mild climate. The guava not only grew as individuals, but in some places formed thickets, as it is wont to do further south, almost to the exclusion of other woody plants.

The shell-mounds of the Halifax River region are hammock-

clad. Furthermore their hammocks are so characteristic that the existence of a shell-mound may be known by the woody and herbaceous vegetation. Besides the tropical plants whose occurrence there will be discussed in another article, the live-oaks (*Quercus virginiana*), magnolias (*Magnolia foetida*), spice-tree (*Anamomis Simpsonii*) are usually outclassed by an intimately intermixed growth of palms—the saw-palmetto (*Serenoa minor*) and the cabbage-tree (*Sabal Palmetto*). The Spanish bayonet (*Yucca aloifolia*) grows much more luxuriantly on the shell-middens than elsewhere. The shell-middens being the latest geological formation of shells also represent in their vegetation the latest assembled plant-association.

We were soon north of the Halifax River midden region which, as is evidenced by the middens themselves and their contents, once teemed, so to speak, with the aboriginal red-man. There were Indian villages there as late as the eighteenth century.[1] Further north the inland waters or lagoons are not situated so as to be favorable to the development of the edible mollusks—oysters, clams, and conchs. Consequently, the coastal sand-dunes are in their virgin condition, at least as far as relatively modern time is concerned. Of course, it is still a question if the present dune plant-covering is the original one, or if the "scrub" once held sway there and was later replaced by the present characteristic association.

At any rate, we had a delightful excursion over miles of virgin dunes forced upon us by the temporary closing of a bridge over the inland coast-wise waterway. From the toll chain or "iron bridge" to Ocean City—both words suggestive of largeness or vastness, but applied here to a mere handful of frame houses—we traversed an old trail consisting of two ruts in the sand. The one herb that showed itself frequently was the beach-verbena (*Verbena maritima*), and here, like the zamia on the eastern coast, apparently at or near its northern geographic limit.

The woody vegetation of these dunes was depressed, so to speak, mainly by the action of the ocean winds. Moreover, with the evident approach of stormy weather they had a somewhat depressing effect on one traversing them. There were

[1] See records in Jonathan Dickenson's book entitled "God's protecting Providence, man's Surest Help and Defence in times of greatest Difficulty and most Imminent Danger," etc.

various shades of green, but they were all sombre. Scrub-oaks (*Quercus pumila, Q. myrtifolia*), bay-berry (*Cerothamnus ceriferus*), jaupon (*Ilex vomitoria*), and dune-bay (*Tamala littoralis*) formed the bulk of this vast Lilliputian hammock or forest. Here and there, however, the hardwood covering was broken by large dashes of white or green saw-palmetto (*Serenoa repens*). Occasionally the proportions of palms and hardwoods were reversed. Then, often, dome-like growths of the pale-green scrub-oak (*Quercus pumila*) and the deep-green bayberry (*Cerothamnus ceriferus*) rose from the sea of the saw-palmetto. The slender whip-like twigs of the oaks were sometimes defoliated by the never-ceasing, often violent, winds off the ocean. A dash of a green, quite different from all others, indicated a depressed mass of red-cedar (*Sabina*) which grew here under difficulties. The imminent storm decided us to make haste for Jacksonville, where, also, our proposed studies on some recently discovered prickly-pears were defeated for the time being.

Up to northern Florida the hardwood trees were in leaf. Thence northward, owing to the ravages of repeated frosts, the trees were mostly mere brown or gray skeletons. However, some of these were furnished with greenery by the more or less copious bunches of mistletoe (*Phoradendron flavescens*). This parasitic shrub, like most wood parasites, is evergreen, doubtless because the leaves store up mineral matter so slowly that they can persist on the plant for several years before losing their vitality. The mistletoe was most abundant on the rough-barked kinds of oak (*Quercus*), hickory (*Hicoria*), and sour-gum (*Nyssa*). In the swamp the mistletoe occurred low down on the trees, in the uplands it was almost invariably up in the tops of the tall trees just in the positions one finds the birds in such places. They are responsible for carrying the sticky fruits of the mistletoe from tree to tree or sowing them on the branches where the clumps later adorn the trees.

The uplands were devoid of decided color, except where the pine tree grew. The swamps managed to maintain some green tones in the tangles of evergreen cat-briers (*Smilax*) and the patches of cane (*Arundinaria*). Tufts of mosses also helped out in a small way on the wet logs. In the Carolinas grasses were in evidence. The swamps and streams were decorated with myriads of silver-tipped spears (*Erianthus*) often standing

ten or twelve feet high. Two broad-leaved grasses, curiously enough, representing the two extremes of the grass gamut, were still more conspicuous—the one, Indian corn (*Zea Mays*) which occupied much cleared land, standing at the lower end of the scale, and wild-cane (*Arundinaria tecta*) which occupied much untamed land, standing at the high end of the scale.

The remains of a snow and ice storm were evident in South Carolina. Snow and ice were plentiful in North Carolina, where the pine trees of the South were laden to the extent of a decided drooping of the branches which added considerably to the desolate outlook not at all typical of the South, but quite typical of the winter state of the continent thence northward.

JOHN K. SMALL.

RUBBER PLANTS[1]

Rubber is one of the most important and the most widely used of plant products. First of all, it is material for water-proofing garments and foot wear, a matter of much comfort to the human race. The consumption of rubber in making automobile tires is enormous. It serves many other uses in the arts and industries.

WHAT RUBBER IS

India rubber or caoutchouc is an elastic substance that may be derived from the milky juice of a considerable number of different kinds of plants. Most plants about us have only a watery sap; fruits such as the apple and our garden vegetables like carrots, beets, etc., contain much water which comes from the soil and is carried about in the plant as sap. But many plants in addition to the watery sap have a milk-like juice. For example when you pluck a leaf from a milkweed, spurge, or dogbane growing wild in and about New York City, a sticky milky-white juice exudes. This is called latex and consists of an emulsion or physical mixture with numerous globules suspended in a watery liquid.

Suppose you get a cup of this fresh latex and allow it to stand. The globules rise to the top quite as cream does on milk, and in time a rather hard and solid layer is formed. This change of

[1] Abstract of a lecture given in the Central Display House of Conservatory Range 2 on Saturday afternoon, January 12, 1924.

liquid or suspended globules to solid rubber (coagulation) can be hastened by heat and by stirring.

It may be mentioned that gutta-percha is also obtained from the latex of certain trees growing wild in the Malayan peninsula. This is plastic when heated but is not elastic like rubber. Another latex plant is the Sapodilla plum of the American tropics which yields the *chicle* used in making chewing gum.

History of the Use of Rubber

The ancient peoples of India and China used rubber, chiefly obtained from wild trees of a kind of fig, the plant many of you know as the rubber plant which is frequently grown as a house ornamental. Soon after the discovery of America the Spaniards found certain Indian tribes playing a game with a ball that was elastic and would bound. Columbus himself took some of these balls back to Spain. About the year 1770 the noted English chemist, Priestly, found that this elastic substance would rub out pencil marks and so he named it *rub-ber*. Soon thereafter one inch "rubbers" sold for three shillings each.

The native peoples of tropical America utilized rubber by spreading it over cloth, or over foot-wear, and at first the white man imitated this process. A Scotchman named McIntosh learned to dissolve rubber in naphtha and then spread it on or between cloth. But clothing and shoes coated with rubber became soft and sticky in hot weather or in warm rooms, and brittle and hard during cold weather. So rubber was of little use to mankind until a Connecticut hardware merchant, named Goodyear, after long tedious study and experimentation, learned in 1839 to vulcanize rubber. At that time only a few tons of rubber were used each year, but with this discovery the use of rubber soon absorbed several thousands of tons yearly. Seldom do we stop to think when we put on our goloshes on a rainy morning that for something like 5,000 years of history our ancestors went without such a protection from wet feet.

The Principal Rubber Plants

The world's supply of rubber comes chiefly from the Pará rubber tree (*Hevea brasiliensis*), of which enormous forests exist in South America. This tree has been planted with success in

Ceylon, Java, Dutch East Indies, West Africa, and the Congo. Now, perhaps, about 2,000,000 acres are in the plantings.

Another rubber tree of importance, especially in Central America, is *Castilla elastica*.

Rubber is also obtained commercially from several other species and some of them are cultivated. A sage-brush plant, the guayule, common in Mexico, yields rubber, and a company backed by American capital has been engaged in obtaining rubber from wild plants and in learning how to cultivate the guayule. During the recent world war a survey was made of the rubber-yielding plants growing wild in our western states. About 15 kinds were found in abundance and it was estimated that 300,000,000 lbs. of good rubber could be obtained from these plants in case of national necessity.

Several different kinds of latex-yielding plants from the various greenhouses at the Botanical Garden were assembled for the lecture, also implements used in the various processes of handling crude rubber, and specimens of rubber in various stages of its utilization were brought from the display cases of the Museum for illustration.

A. B. STOUT

PUBLIC LECTURES DURING APRIL

The following lectures, which are open to the public without charge, are given in the Museum Building on Saturday afternoons at four o'clock:

April 5. "Potatoes and Potato Substitutes." Dr. H. H. Rusby

April 12. "A Visit to the Yellowstone National Park." Dr. P. A. Rydberg.

April 19. "Destructive Fungi." Dr. F. J. Seaver.

April 26. "Botanizing in Sweden." Dr. W A. Murrill.

NOTES, NEWS, AND COMMENT

A South American collection of the utmost importance, which has been recently incorporated in the herbarium, is that secured by Dr. F. W. Pennell, Mr. E. P. Killip, and Dr. T. E. Hazen in Colombia. This amounts to about 4500 sheets and contains a considerable number of new species.

Specimens of several species of lilies were forced into bloom .t the experimental green houses during the winter for ex-.ibition at the Eleventh International Flower Show. The main)urpose of these forcings is to have for display some of the hardy ilies that are most attractive and suitable for the flower garden. This year, individuals of the orange lily (*Lilium croceum*), Miss Wilmott's lily (*L. warleyense*), and the regal lily (*L. regale*) were specially fine.

The large collections of wild iris recently made in South Carolina and Florida by Dr. John K. Small with the coöperation of Mr. Charles Deering, are growing luxuriantly in the Propagating Houses and in cold frames and bid well to bloom in the late spring. Thus several important questions involved in our native iris may be solved, and the new species studied and painted for illustration in *Addisonia*. Duplicate collections have been installed in the Deering reservations in southern Florida.

Professor A. S. Hitchcock, of the Bureau of Plant Industry of the U. S. Department of Agriculture, returned late in February from an extended visit to Ecuador, Bolivia, and Peru, where he has been engaged in studying and collecting grasses and other plants for the U. S. National Herbarium, Harvard University, and The New York Botanical Garden. Copies of his letters, describing his experiences in South America and forwarded to the Director-in-Chief of the Garden, have formed the basis of several interesting articles in *The New York Times*.

Dr. H. A. Gleason has received from British Guiana and prepared for distribution a sixth set of the plants of that interesting region, collected by J. S. de la Cruz and containing about 950 numbers of flowering plants. Preliminary studies of these plants indicate that they include several new species, hitherto unknown to science, among them a new representative of the poorly known family *Rapateaceae*. The collections of de la Cruz now exceed 3500 numbers and are proving of great value in the investigation of the flora of northern South America, carried on by the Garden in coöperation with the National Herbarium and the Gray Herbarium of Harvard University.

"Seven Thousand Dahlias in Cultivation" is the title of a valuable pocket-sized booklet compiled and recently published by Prof. J. B. S. Norton of Hyattsville, Maryland. It consists of alphabetically arranged varietal names, each followed by the

name of the originator, year of origin, class, color, and the number of catalogues listing the variety during the last three years. A confessedly incomplete list of dealers in dahlias includes 223 names of commercial growers, located in the United States, Canada, Great Britain, France, Belgium, Holland, and Germany. The primary object of Professor Norton's book is said to be to make it easier for the originators of new varieties to avoid the duplication of names already in use, but many dahlia-growers will prize even more the information in regard to the origin of the varieties that they cultivate.

It was no sooner recorded in the *Journal* early this winter that the great horned owl had not been seen in the Botanical Garden for the last twenty years than one promptly put in an appearance. The bird was reported now and then, for several weeks, in the hemlock grove, usually seen sitting well concealed in the top of some tall tree. Probably there was no mate about, as there were none of the bird's well known call-notes or hooting reported; nor was the harsh scream heard, so unlike its call notes that it is often not attributed to a bird at all. This scream is one of the harshest noises to be heard in the forest, is usually uttered as darkness is coming on, and one might well imagine it is for the purpose of startling any small animal into motion so that it could be more easily detected and captured by this king among his kind. The crows, it would appear, finally got the best of our park owl, for on the morning of January 15th a loud cawing was heard some half mile away and on approaching the spot whence the chorus proceeded, a great horned owl flew from the top of one of the tallest trees, closely followed by twelve or fifteen crows, all doing their best to make life miserable for a sleepy bird. The owl finally lit in a distant tree-top, from which he was again routed in short order, and pursued and pursuers finally disappeared in the distance. The crows all seem to have returned safely but no large owl has since been reported.

One of the numerous cases illustrating practical applications of "pure science," in this case the science of botany, is found in a decision recently handed down by the United States District Court in Little Rock, Arkansas. Suit was brought by the U. S. Government to void the title of claimants to extremely fertile lands valued at about $1,500,000 and occupying the sites of

what were indicated as lakes on maps made by government surveyors seventy five years ago. The U. S. Government contended that no such lakes existed at that time and that its own surveyors sketched them in because they were paid three dollars per mile for running the curved boundaries of lakes and only one dollar per mile for running ordinary straight lines. The Government's contention was defeated by the testimony of botanists, largely by that of Prof. George P. Burns of the University of Vermont and Dr. Hermann von Schrenk of St. Louis. Trees and other plants were considered to be reliable witnesses as to the existence and the boundaries of the former lakes. The swamp cypress (*Taxodium* sp.) when growing in shallow water develops from its roots peculiar upright "knees" which commonly reach the high-water level and appear to act as breathing organs. In deeper water it has a fluted trunk and on drier soil its trunk is more like that of ordinary trees. By observing the distribution and character of the cypress trees and the marginal upland trees and counting the growth rings in their trunks it was shown that the lakes existed there seventy five years ago, as indicated on the old government maps. The silent testimony of the cypresses was supported by remains of other characteristic aquatic or semi-aquatic vegetation belonging to characteristic lake succession for that region. Instead of this rich bottom land now being thrown open to new settlers, the present occupants, some of whom inherited their holdings from their forefathers, will continue to enjoy their property rights.

The following visiting botanists have enrolled in the library during the winter months: Prof. Shigenori Kawagoe, Kagoshima, Japan; Prof. Oakes Ames, Harvard University; Dr. Ralph R. Stewart, Rawalpindi, India; Prof. H. M. Fitzpatrick, Ithaca, N. Y.; Mr. U. P. Hedrick, Geneva, N. Y.; Mr. Edwin P. Bartram, Bushkill, Pa.; Mr. John C. Wister, Philadelphia, Pa., and Prof. J. Massart, Brussels, Belgium.

The best germination results so far with hemlock (*Tsuga canadensis*) in our propagating houses are with seeds collected in December, sown the 8th of January, in pans containing leaf mold and sand, equal parts, and placed in full sunshine in a warm house. Several pans of these are comfortably filled with seedlings, but the exact percentage of germination is not known.

Several plants of the Pride-of-Madeira, *Echium fastuosum*, are flowering for the first time in the Central Display House of Range 2. These are from seed sent from Lady Hanbury's garden, La Mortola, on the Italian Riviera, where several kinds flower freely in an environment similar to that in Madeira and the Canaries, their native home. These echiums are rather curious spreading shrubs, and the light-blue flowers with showy purple filaments are borne at the end of branches in crowded spikes. Mrs. Wheeler H. Peckham says that their blooming at La Mortola is a notable event of the season.

In the February issue of the *Journal* attention was directed to the flowering of the various species of Witch-Hazel (*Hamamelis*) in the shrub collection of The New York Botanical Garden. Although most of these shrubs have passed flowering, a few are now (March 17) in full bloom and are very attractive at this early season, when most of nature is not yet astir. The Asiatic Hazelnut (*Corylus pontica*) has been flower for several days and the catkins are now about through shedding their pollen. The catkins of a number of willows and poplars are beginning to peep from their winter coverings, while others are more advanced.

Meteorology for January. The total precipitation for the month was 4.89 inches, of which 0.20 inch (2 inches by snow measurement) fell as snow. The maximum temperatures recorded for each week were 45° on the 3rd, *57° on the 11th*, 56° on the 16th and 50.5° on the 25th. The minimum temperatures were 9° on the 6th, 24° on the 8th, 19.5° on the 15th and *5° on the 27th*.

Meteorology for February. The total precipitation for the month was 3.12 inches, of which 0.95 inches (9.5 inches by snow measurement) fell as snow. The maximum temperatures recorded for each week were *52.5° on the 3rd*, 39° on the 9th, 43° on the 15th, 40° on the 24th and 48.5° on the 26th. The minimum temperatures were 15° on the 9th, *8.5° on the 13th*, 11° on the 24th and 22.5° on the 27th.

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Bronx Park, New York City

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THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

VOL. XXV APRIL, 1924 No. 292

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OF

THE NEW YORK BOTANICAL GARDEN

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THE SPICES OF COMMERCE

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A UNIQUE LECTURE HALL

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STANDARDIZED PLANT NAMES

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NOTES, NEWS, AND COMMENT

ACCESSIONS

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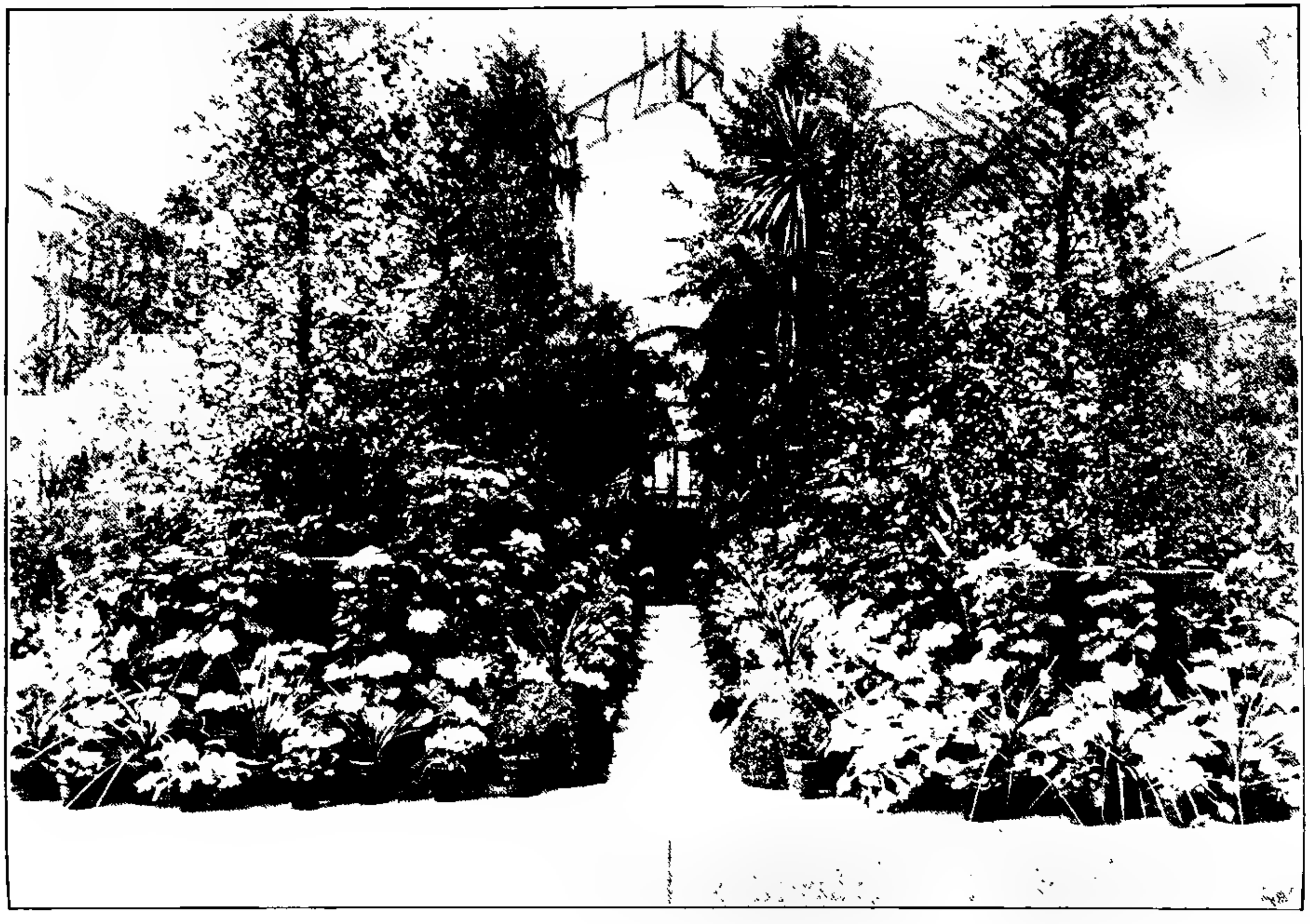

View in Central Display House, Conservatory Range 2, March 3, 1924, looking westward from the winter lecture-course floor

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THE VIABILITY OF DATE POLLEN[1]

(WITH PLATES 289 AND 290)

For a period of six or eight weeks each spring the artificial or hand pollination of dates is the chief and most important task of the date-growers in the Coachella Valley and in the Imperial Valley in California as well as in the Salt River Valley in Arizona. Day after day the "pollinator" makes the rounds of the plantation, equipped with the tools and supplies necessary for the work at hand. At the time when a cluster of female flowers is opening the operator climbs into the tree and places either a cluster of male flowers or the pollen from such flowers among the female flowers. It is his hope and trust that the currents of air will so scatter the many thousands of minute pollen grains that some will reach the stigmas of the various female flowers and that there will be a good set of fruit. The particular methods employed by growers differ somewhat in detail but the principal feature of the operation is the same and has remained thus during the centuries that dates have been under cultivation.

It is the general practice to grow few male trees, as this entails less expense for cultivation, fertilization of the soil, and irrigation—all items of expense in a crop requiring such intensive cultivation as does the date. The clusters of male flowers are carefully cut and the great abundance of pollen produced by them is collected and conserved for use when needed.

Pollen is truly "gold dust" to the date-grower. But its value and the success of its use in pollination depend first of all on its viability—on whether it will grow. The date gardener

[1] Reprinted with a few changes in wording from The Los Angeles Times, Farm and Tractor Section, for May 20, 1923. A report of investigations in collaboration with Dr. W. T. Swingle of the U. S. Department of Agriculture.

knows very well from experience that pollen readily becomes mouldy and that it will "cake" and become "sour" unless it is properly dried and stored and so he pays special attention to what he considers to be the best means of preserving its vitality. To him the question of how long this pollen will then keep is one of special interest. It is in fact a matter of vital importance to the date-growing industry.

It is a tradition of the Arabs, going back to remote time, that the pollen of the male date tree remains potent from year to year

FIGURE 1. The "Gold Dust" of the date industry. When properly dried and stored date pollen remains viable for at least several weeks. This quart jar (here reduced in size) contains 1922 pollen which gave no germination in the tests a year later. From this jar came the apparently dead pollen shown in lower part of PLATE 290.

or even for several years and in times of scarcity of new pollen it has been their practice to use old pollen in the pollination of the female flowers. Relying on these Old World traditions and practices, the growers of dates in California and Arizona have believed that when the pollen of dates is properly dried and stored it remains viable for several years and they have repeatedly used such pollen early in the season with apparently good results in certain cases. They have not questioned the results of this practice and have, therefore, not felt it necessary to direct special attention to the growing of early-flowering males which

would furnish new pollen for the earliest bloom of the female trees.

During the past season of bloom (spring of 1923) the writer, working at Pomona College and at the Government Date Garden at Indio, California, has studied the viability of date pollen by means of direct germination tests. Evidently this is the first time that this method has been employed in the study of date pollen. The results indicate that date pollen does not remain viable from one year to another.

Four hundred and sixty-four (464) tests were made of twenty-nine (29) different lots of pollen one or more years old that had been carefully dried and stored under the best of conditions employed by date-growers in the Coachella Valley. In each test hundreds and often thousands of pollen grains were used. In all these tests only three germinating pollen grains were found and these were undoubtedly stray grains of new pollen which was being tested in the laboratory at the time. Old pollen that had been kept sealed in vacuum tubes gave no germination. At the same time fresh pollen from good males gave excellent germination. It seems conclusive that pollen one year or more old is unable to grow and is entirely worthless in effecting fertilization and the setting of fruit.

The method employed in the test for germination is simple but effective and very reliable. An agar-sugar preparation or "medium" is made, not much different from the "jello" or the "fruit agars" of culinary art. The methods of preparation and sterilization are the same as those used in the common practices of bacteriological research. In preparing for a test of pollen, a tube of the prepared and sterilized medium is heated to the melting point, a drop is placed on a glass slide and as soon as this solidifies and is cool the pollen is scattered over the surface. The slide is then placed in a moist chamber for a period of several hours. Many preliminary tests are of course made to determine the kind of sugar and the particular concentration that is most favorable for the growth of the pollen tubes. By this method numerous samples may be tested and the results obtained during a single day's work in the laboratory.

Date pollen that is viable readily germinates on a 1% agar with 3%, 5% or 10% of cane sugar. The pollen tubes make a delicate threadlike growth quite identical to that which grows

from them into and through the tissues of the pistil to function in fertilization. With the use of a microscope giving 75 to 100 diameters magnification the individual tubes may easily be observed and the percentage of germination may be determined. The use of appropriate stains facilitates this study.

A case of excellent germination is shown in the upper half of PLATE 290 with a magnification of 90 times. Nearly every pollen grain in this sample of fresh but dry pollen produced a tube which made a vigorous growth. In the lower half of PLATE 290 is a view of pollen one year old submitted to the same test but showing no germination whatever. When pollen grains one year or more old are placed on the agar-sugar preparation they absorb water, swell up, and become plump and well rounded out, but they have thus far exhibited no signs of growth and life. They appear to be dead.

It is perhaps possible that old pollen may germinate on the stigmas of the female date flowers even when it does not do so on the medium which gives successful germination of new pollen. But the very decided differences observed in the tests —the excellent germinations repeatedly obtained from new pollen in contrast to complete failures of old pollen to germinate—make this unlikely.

Inquiries among growers reveal that many of them mix the first of the new pollen of a season with old pollen kept from the previous year. The results of using such pollen do not constitute a test of efficiency of the old pollen, for even thus diluted a superabundance of the new pollen is no doubt often used. In the instances when old pollen has been used exclusively, there has evidently been no adequately guarded pollination which would exclude any new pollen that might be carried in the air from male trees that were in bloom or that might soon come into bloom, either in the same plantation or elsewhere in the region. The very light and minute pollen of the date palm is no doubt widely disseminated by movements of air. Date growers frequently get a good set of fruit from clusters of flowers left to open without attention.

One manager of a date plantation in the Coachella Valley reports decidedly poor results when he has used old pollen for the pollination of early blooms of female trees. Another grower says that the results have made him somewhat "suspicious of old pol-

len" but he has this season again used such pollen for more than 50 clusters of flowers. Another grower has used old pollen to a considerable extent. None of his 1922 pollen gave any germination when tested in April, 1923. When apprised of this condition he remarked, "That seems to explain the poor results I obtained last year from the use of old pollen."

Dr. W. R. Faries states that several years ago, probably in 1918, he used pollen of the year before to pollinate early blooms in January when no males were out and got no fruit to set.

Apparently, however, nearly all growers have proceeded with confidence in the traditions and practices of the Old World date-growers and have very generally attributed such failures as they have experienced from using old pollen to incidental conditions rather than to the complete death of the old pollen. A conclusive pollination test of old pollen has not been made. It could best be made from the first female flowers to open in spring, employing the bagging method to exclude any stray pollen. A few such tests would readily show whether old pollen which does not germinate on various culture media can function directly on the pistils.

The germination tests of the pollen of date palms have been made only during the present season of bloom. It is perhaps possible that under unusually favorable conditions pollen may sometimes remain viable from one year to another. But in the extensive tests made this year no old pollen has shown any trace of being viable.

The practices of hand pollination now employed require that pollen be kept during the season for use from day to day as needed. This raises the question of how long pollen will remain viable. Several lots of pollen collected early in the season, some as early as February 19, 1923, have given excellent germination as late as April 12, following. This pollen remained viable during a period of nearly two months.[1] Such evidence indicates that when pollen is properly cared for it can be kept and used with success during one season of bloom.

The direct germination test on a culture medium makes it possible to determine only a few hours in advance of its contemplated use in pollination whether a given lot of pollen is viable or not. It

[1] Tests as late as May 31 also gave good germination, suggesting that date pollen dies at some time during the summer.

also enables one to evaluate or grade male trees as to the germinating quality of their pollen, a matter of considerable importance in determining the "best" males. It enables one to determine if the pollen of any cluster of flowers from males usually good is poor because of time of bloom, age of the tree, or of local environmental conditions. Thus in many ways it will aid the date-grower in making more certain the important operation of the pollination of his dates. It can reveal whether the pollen is comparatively more precious than "gold dust" or as worthless as an equal amount of sand.

One aspect of the results demands the attention and action of date-gardeners. It is certain that present methods of drying and storing pollen do not keep it in a viable condition from one year to another. It remains to be shown whether date pollen can ever be kept viable from one season until the next season of bloom. The evidence now at hand rather decidedly indicates that it is not and perhaps cannot be thus kept and that growers of dates must provide early blooming males to supply fresh pollen, if they wish to pollinate the earliest clusters of female flowers with success.

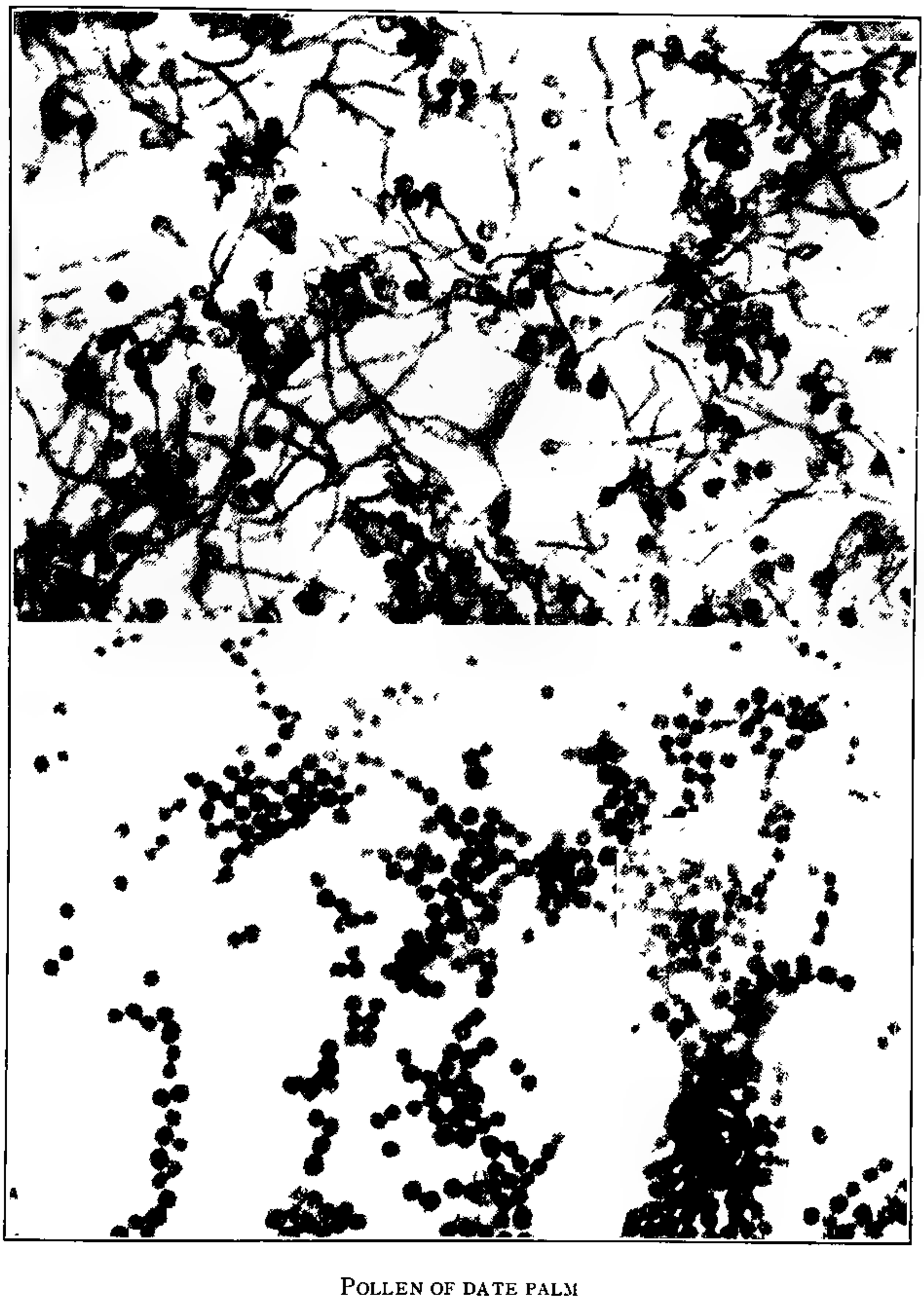
A. B. STOUT.

EXPLANATION OF PLATE 289

Above. Young male date palm, showing clusters of male flowers. When these clusters are cut and placed in a dry room, the pollen which falls from the opening stamens may be dried and kept for future use. It may be kept viable for several weeks, but apparently does not remain alive from year to year, as growers in both the old and new worlds have believed.

Below. Female palm tree with flowers, shortly after the proper time for pollination. Note bunch of male flowers placed close to female flowers for pollination, a simple but effective method, insuring free scattering of the light pollen by currents of air. Sometimes male flowers are placed within each cluster of female flowers. A common practice is to sprinkle pollen on cotton and place this within the female cluster. It is imperative that pollen thus used be viable if a good set of fruit is to result.

YOUNG DATE PALMS IN FLOWER, INDIO, CALIFORNIA



POLLEN OF DATE PALM

Above. Sample of fresh 1923 pollen from a good male, showing good germination on the agar-sugar medium (magnified about 90 times). When such pollen germinates on the pistils of the date flowers, the tubes grow down into the ovaries and function in the processes of fertilization, which are necessary for the proper formation of fruit.

Below. One-year-old pollen which failed to germinate in the tests. The grains swelled to rotundity but no pollen tubes developed.

TROPICAL AMERICAN PLANTS AT HOME

1. The Begonias

During nearly forty years' study of the tropical American flora, the publications of the writer have related chiefly to the taxonomic and economic features of the plants discussed. In the meantime, his extensive experience in traveling and collecting has contributed much interesting information concerning habits of growth and appearances in nature of many plants which are favorites in cultivation. It is hoped that time may be found for the contribution of a series of articles on these interesting groups.

The Begonias, as decorative plants, have always been valued chiefly for their foliage effects, a statement that should be qualified by saying that, for several decades, great attention has been given to the development of floral display in a number of species, especially in the tuberous-rooted group, now so largely grown in the conservatory, which have contributed a unique floral form of exquisite beauty, combined with colors of exceptional clearness and delicacy.

In habit of growth, the Andean species, the only ones that I have encountered in nature, may be classified into four groups: (1) Dwarfs, either without stems, or with stems only a few inches high, and with spreading, mostly radical, leaves; (2) low species with leafy stems, but the foliage rather sparse; (3) very tall species, with unbranched stems, leafy and flowering only at the top; (4) species with stems of indefinite length, prostrate, reclining or climbing.

Of the first-named group, I have encountered but two, both of them tuberous-rooted and practically stemless. I regard them as among the most pleasing of all the Begonias that I have seen growing wild. *B. Weddeliana* A. DC., was discovered by, and named in honor of, Hugh Algernon Weddell, an early and energetic Andean collector, remembered for his valuable contributions to our knowledge of the quinine-yielding trees. This species occurs at the higher elevations of the tropical mountains, not far below the frost level. I encountered it at Unduavi, a day's ride by mule to the eastward of La Paz, in a deep forested valley. No Begonias, so far as I know, are strictly gregarious, but this comes near to being so, as it grows in patches, very much like our Hepatica or Syndesmon. Its favorite location is on partly

shaded banks, near streams, and surrounded by Selaginellas, low ferns, Peperomias and Lycopodiums. Its tubers are small, about half the size of crocus bulbs and of irregular form. The leaves are nearly prostrate, obliquely heart-shaped and of a rich glossy green, the flowers brightly rose-colored and about one and a half inches broad. It is a strikingly beautiful plant, and especially pleasing to a northerner, who is at once reminded of a bank spangled with blood-root. Very similar to this species is *B. pleiopetala* A. DC., which grows in the same general region, but at somewhat lower altitudes. It is only 3 or 4 inches high. Its leaves are less oblique, its flower-stems are almost filiform, and its flowers a little smaller than those of Weddell's Begonia, and with narrower petals, of paler color. A number of tuberous species similar to these have been introduced to cultivation from Bolivia, Peru, and Ecuador, and their flowers have been much enlarged and improved by the gardener's art.

The second group mentioned is by far the most numerous. So far as the Andean species are concerned, probably nine-tenths of them belong here, and they constitute one of the most conspicuous elements in the flora. They inhabit all varieties of soil, though usually amidst rocks, and with every form of exposure. They may grow to a height of two or three feet, and branch freely. Their flowers range from white, through pink or rose-color to a brilliant scarlet, and are usually rather scanty in comparison with the amount of foliage, which is exceedingly diverse as to form, surface, and color. One of the commonest and handsomest members of this group is *B. sanguinea* Raddi, so named because of the blood-red color of the entire plant, with the exception of its waxy shining green upper leaf-surfaces. The flowers are large and of a cherry-red color, the leaves very oblique, cordate, and pointed, with entire margin. This species grows singly and mostly in the shade of forest trees. When the sun strikes it fully, displaying here a shining green and there a blood-red leaf surface, the effect is peculiarly handsome. In strong contrast with this is a species of sunshine, located on rocky banks and cliffs. It is most abundant at an altitude of 2000 or 3000 feet. It resists aridity strongly and may be found in flower when most of the plants about it are desiccated. Floating down the Bopi River, one encounters its brilliant display at every turn of the river.

The members of this group are as notable for their great diversity of vegetative characters as for their number and wide distribution. While most of them are perfectly smooth, many are densely clothed with hairs or scales of various forms and colors. *B. fagopyrcides* Kunth & Bouché, so called from its general resemblance to a buckwheat plant, is very hairy. *B. ulmifolia* Hooker is a somewhat similar species, but its hairy covering is much shorter. Its peculiar character, and a very beautiful one, is its densely serrate leaf-margin, the teeth long and slender and fringed with glistening hairs. *B. antioquiensis* (A. DC.) Rusby, common from central Colombia to Bolivia, instead of being hairy, is shaggy with lanceolate, tapering reddish-brown scales. In contrast with these is *B. Bangii* Rusby, of central Bolivia, which is extremely smooth and shining throughout, about one or two feet high, freely branching and abundantly clothed with thin leaves of a vivid green, and sharply and deeply angular-lobed. It produces large, broad loose cymes of white flowers of medium size, and is almost as handsome in fruit as in flower. *B. heterodonta* Rusby, with teeth of very variable size and form, and *B. subcostata* Rusby, with lightly ribbed leaves, are water-lovers, and are found in deep shade, in wet places, among mossy rocks, against which they often recline to a height of two feet or more. *B. lignosa* Rusby, on the other hand, grows on dry banks and has very long and much branched woody or half-woody red stems, with exfoliating bark, and clothed with very large and conspicuous reddish stipules. Its leaves are small and beautifully doubly serrate, and it has large flowers in broad loose clusters. *B. oblanceolata* Rusby is similar, but its leaves are almost perfectly symmetrical, tongue-shaped, with rounded summit, a very unusual form in this genus. *B. Williamsii* Rusby & Nash, from central Bolivia, is notable for its production of green flowers. The plant is of a vivid-green and the leaves are deeply triangularly lobed. It has been grown in the conservatory of The New York Botanical Garden. An undetermined species, growing near La Paz, at very high altitudes, has the large, cordate, sessile, pointed leaves almost exactly symmetrical, a form rarely seen among Begonias.

Most peculiar among Begonias is a small group of species with long, naked, flexuous stems, growing in clusters, like bamboos. They are sometimes so tall that a man on mule-back may reach

up to secure the flower-clusters. As the stems ascend, the lower leaves fall, leaving large scars. The plants have an umbrella-shaped crown of immense leaves, with broad compound cymes of flowers in the center. *B. parviflora* Poepp. & Endl. is the best known of this group, having been frequently collected in Peru and Bolivia. Its leaves are often two feet in breadth and remind one strongly of those of Gunnera. They are harsh to the touch, especially on the coarse ribs beneath and are lobed two-thirds or more of the way, the lobes being lanceolate, long-acuminate, and acute. *B. myriantha* Britton is of similar habit and general appearance, but its leaf-lobes are short and irregular and are coarsely and irregularly dentate. The young leaves are clothed on the lower surface with a dense rusty-brown felt. The flowers are even smaller than those of *B. parviflora*, and are of a purplish-white color.

Handsome and interesting as are many of the forms above described, I think my favorite Begonias are to be found among the climbing or reclining species. The most conspicuous member of this group is *B. Clarkei* Hooker, widely distributed and abundant in the Andes, and somewhat known in cultivation. Perhaps its most striking peculiarity is the altitudes to which it attains. My first acquaintance with it was made on the treeless summits of the eastern Cordillera, probably 13000 feet above sea-level. I had risen with the sun, after a night of fearful discomfort and some danger from the cold, and this plant was almost the first object that I encountered, its huge leaves and immense rose and white flowers, on thick fleshy stems, covering the top of a snow-covered stone pile near at hand. I dug among the stones, in a search for the root, but after going down about four feet, where the stems were nearly as thick as my wrist, I abandoned the attempt. On another occasion, I found the underground portion to be a thick and hard rhizome, irregularly tuberous-thickened in places. The leaves are thick and fleshy, very lustrous, eight inches or more in breadth, reniform and beautifully crenate-dentate. The flowers are often two and a half inches in breadth. *B. Clarkei* must be regarded as a reclining species, but *B. scandens* Swz. and *B. glabra* Aubl. are genuine climbers. Both grow among dense undergrowth, in deep shade, and rooted in abundant decaying vegetation. Their slender stems, creeping and rooting amidst this forest refuse, are naked, but the elongated pale-green

branches, projecting from the undergrowth, or climbing some convenient trunk, are clothed with light-green fleshy leaves and dense clusters of fairly large snow-white flowers, the clusters not unlike a small "snow-ball" or Viburnum. I remember one plant of *B. scandens* that spiralled its way up a small trunk to a height of seven or eight feet, so abundantly clothed with flowers as to form a veritable festoon. The effect was heightened by the drooping habit of the cymes, which possessed rather long stems. The flowers being deliciously, though delicately fragrant, it is not strange that I remember this encounter as one of the exceptional delights of my tropical collecting.

H. H. Rusby.

THE SPICES OF COMMERCE[1]

Although our common spices are natives of the East Indies and the Malayan Archipelago, they have been known to European or Oriental civilization for thousands of years. The Old Testament, as far back as the book of Exodus, contains numerous references to them, showing clearly the great value placed on them. Several spices were used in ancient Egypt; pepper was worth its weight in gold in Rome two thousand years ago; six hundred years ago in England a pound of cloves was worth as much as two cows.

During all this ancient period the source of spices was unknown to the Europeans. The Egyptians and the Phœnicians obtained them from Arabian merchants, or through Bagdad, and passed them on, always at an immense profit, to the nations still farther west. How they obtained them is unknown, but references in Arabian Nights to fabulous and hazardous voyages to the land of spices would indicate that some sort of maritime trade to the East Indies had been developed over a thousand years ago, probably through the Persian Gulf and down the coast of India.

The modern history of spices begins some six hundred years ago with the development of Venetian commerce, and from that time on, through a span of some four centuries, the struggle between European nations for a monopoly of the spice trade was

[1] Abstract of a lecture delivered in the Central Display House of Conservatory Range 2, on Saturday afternoon, March 15, 1924.

the direct and immediate cause of a series of events which have been of the utmost importance in shaping the history of civilization. It can safely be said that no group of plants, large or small, has had as great historical influence as these few East Indian plants which furnish us with our now cheap and common cinnamon, cloves, nutmeg, ginger, and pepper.

During the height of Venetian prosperity in the fifteenth century, its merchants obtained their spices chiefly from Alexandria, whither they were brought overland from the east by caravans. Venetian fleets distributed them to the rest of Europe, and at so great a profit that the cupidity of the Portuguese was aroused. They determined to discover if possible a sea route to the Far East, by sailing south along the coast of Africa. Their explorations were pushed farther and farther to the south, and finally they succeeded in rounding the Cape of Good Hope, sailing up the east coast of Africa, crossing the Indian Ocean, and loading their ships direct from the East Indies. Under the leadership of Vasco di Gama, they entered on a career of piracy and warfare in the Far East which soon gave them the monopoly of the coveted spice trade. This they largely retained through the sixteenth century.

About the same time Christopher Columbus, imbued with the remarkable idea that the world was round instead of flat, set out to sail westward to the East Indies and discovered America instead. Magellan, seeking the same goal, was the first to succeed, and he returned to Spain from the first circumnavigation of the world with his one remaining ship loaded with spice. The Spanish were unable to wrest the East Indies from the Portuguese, but did gain control of the Philippines, and for two centuries fleets of Spanish galleons brought back the wealth of the East across the Pacific Ocean to Mexico, and thence across the Atlantic to Spain.

The seventeenth century marked the rise of the Dutch commerce to the East Indies. They had recently freed themselves from Spain, they were excellent sailors and good fighters, and they soon won for themselves not only a monopoly of the spice trade, but also the enormous island empire which they still retain in the Far East.

Early English attempts in the same direction were largely confined to efforts to discover a northwest passage or a northeast

passage, but they became, nevertheless, involved in repeated trouble with the Dutch, which was not finally settled until the close of the Napoleonic wars.

One result of this struggle of four centuries was the steady reduction in price of the spices. The producers received more, and the greater supply brought down the selling price in Europe. Instead of a profit of a thousand-fold, or even more, merchants had to be contented with a reasonable gain. With the fabulous profits of the old trade gone, spices were no longer a cause of bloodshed, piracy, and war, and during the last century the spice industry has lost its romance and has settled down into a respectable position in the commerce of the world.

Of the numerous kinds of plants which are or have been used as spices, only seven are of sufficient importance in this country to require special mention here.

The clove, *Eugenia caryophyllata*, belongs to the Myrtle Family, a group noted for the possession of aromatic properties. It is probably a native of the Molucca Islands. The spice is produced by the flower-buds, which are picked before opening and dried. The two chief sources of cloves today are the island of Penang, a British colony north of Singapore, producing about 10 per cent. of the world's supply, and the island of Zanzibar, off the east coast of Africa, producing about 90 per cent.

The nutmeg, *Myristica moschata*, belongs to a small group known as the Nutmeg Family. It is likewise a native of the Malayan region, and our chief supply still comes from the Dutch island of Banda. It is also extensively cultivated in Grenada, of the West Indies. The nutmeg tree bears a fruit about the size of a peach, which opens and exposes the single dark seed surrounded by a crimson network. The latter, stripped from the seed and dried, is known to us as mace, while the seed itself, after the husk is removed and the kernel dried, becomes our familiar nutmeg.

Cinnamon is the bark of the cinnamon tree, *Cinnamomum zeylanicum*, a native of Ceylon and a member of the Laurel Family, a group also well known for its aromatic properties. In cultivation, the plant is kept cut back to the ground, and sprouts two years old are used as a source of the bark. This is removed from the stem and dried into the form familiarly seen in our markets. Ceylon is still the chief source of cinnamon.

Ginger is produced from the root of the ginger plant, *Zingiber officinale*, a member of the Ginger Family and probably a native of India, but now extensively cultivated throughout the Tropics. Ordinary ginger is prepared by washing or boiling the roots and then drying them, while candied ginger is made by boiling the roots in sugar syrup.

The pepper, *Piper nigrum*, is a climbing vine of the Pepper Family and is a native of tropical Asia. The unripe berries, dried and ground, produce the common black pepper, while white pepper is prepared from the ripe berries by soaking and washing off the pulp, drying and grinding the seeds.

The western hemisphere has contributed only two of the common spices of commerce.

Red pepper, in its countless varieties and forms, is the fruit or seeds of various species of the genus *Capsicum*, a member of the Nightshade Family, which also includes such diverse and well-known plants as the potato, the tomato, and the tobacco. Both fruits and seeds of these peppers are used, either fresh or dried, whole or ground, and we know them as red pepper, Cayenne pepper, sweet pepper, chillies, pimentos, and paprika.

Allspice is the dried green fruit of the allspice tree, *Pimenta Pimenta*, a close relative of the clove. Jamaica is the original home and also the chief center of production of the spice.

H. A. GLEASON.

LILIES AT THE FLOWER SHOW

The various exhibits of lilies at the Eleventh International Flower Show recently held at the Grand Central Palace undoubtedly surpassed all other winter exhibits ever held in America, if not elsewhere, in the number of species represented.

The several prizes for lilies in pots or as cut flowers grown by private and commercial growers brought out, as usual, excellent displays of the Easter Lily and the Madonna Lily. It was the prizes for open class (no. 185) competition for "collection of lilies, in pots, not less than 50 square feet, ferns permitted for decorative effect" that brought out two splendid exhibits of a large number of different kinds of lilies.

The first prize of $100.00 for this class, offered by Mrs. Mortimer J. Fox, was awarded to Mrs. John T. Pratt, Mr. J. W. Everett, Superintendent, of Glen Cove, Long Island. This exhibit of about 250 plants included eight different species, as follows:—Tiger Lily (*L. tigrinum*), *L. rubellum*, Golden Turk's-cap (*L. Hansonii*), Candlestick Lily (*L. dauricum* or *L. umbellatum*), Showy Lily (*L. speciosum*), Madonna Lily (*L. candidum*), Easter Lily (*L. longiflorum*), and Nankeen Lily (*L. testaceum*).

The second prize of $75.00 for class 185, offered by the Heermance Storage and Refrigerating Co., was awarded to Mrs. Harold I. Pratt, Mr. Frank Johnson, Superintendent, of Glen Cove, Long Island. This exhibit included about 250 plants with specimens of the six species last named above and in addition plants of each of the following:—Coral Lily (*L. tenuifolium*, both of the scarlet-flowered type and the variety Golden Gleam), Regal Lily (*L. regale*), *L. Brownii*, *L. Parryii*, and *L. parvum*.

There were also on display 21 plants grown at The New York Botanical Garden and exhibited by Mrs. Mortimer J. Fox. These included two plants of the Dwarf Elegans (*L. elegans*), four plants of Miss Wilmott's Lily (*L. warleyense*), six plants of the Regal Lily (*L. regale*), and nine plants of the Orange Lily (*L. croceum*). These are all hardy and easily grown lilies and they were shown as an educational exhibit of what the Garden is now doing with lilies in coöperation with Mrs. Fox. This exhibit was awarded a gold medal.

Thus there were on display plants of sixteen different species nearly all of which are hardy for out-door planting in the vicinity of New York but of which several of the best are rather rarely seen in private gardens. The displays attracted considerable attention and many inquiries were made regarding the individual kinds and their value in out-door plantings.

Most of the kinds of lilies mentioned above and many others not mentioned will be in bloom at their proper season in the display plantings at The New York Botanical Garden.

A. B. Stout.

A UNIQUE LECTURE HALL

(WITH PLATE 288)

During the February and March courses of greenhouse lectures, a small Cineraria show was set up in the Central Display House of Range 2. Some three hundred dwarf large-flowered plants of the Dreer strain were flowered for the Cineraria lecture of February, as an example of a type that can be grown by persons with a small home conservatory. The plants of the *stellata* and larger types of this beautiful flower formed the background, with the smaller in front, as viewed by the audiences at the lectures (see FRONTISPIECE).

Since the first photograph of the Central Display House was published in the *Journal* (**20**: *pl. 240.* 1919), the warm-temperate trees and shrubs have grown rapidly. The great dome of this house seemed wholly adequate at that time to cover the variety of plants rooted in the ground. Now cedars and araucarias are nearing the glass. These, with the Bermuda Red Cedar, Canary Pine, *Podocarpus*, Bottle-brush, and Queensland Tulip-tree, form an evergreen background to the whole.

In the right background corner are Australian trees and shrubs; in the left corner, semi-tropical fruits such as Loquat, Feijoa, Fig, etc. The center floor view, looking in either direction, is perhaps the most inviting, embracing the pools and running brooks, with banks of *Selaginella* and *Helxine*. The latter is the dainty small-leaved plant which carpets the floor of the miniature forest under glass, spreading as if by magic wherever planted. The front corners of the Cineraria display are set off by green pyramids of this plant which the gardeners have made by stacking pots of different sizes and allowing *Helxine* to creep over the whole. This little plant is native of the coasts of Corsica, is sometimes called the Corsican creeping nettle, and has been offered as a rock-garden plant in warmer climates than ours. The New York Botanical Garden has introduced it into many private and public conservatories, for the decoration of which no plant is more charming. *Helxine* is particularly happy under benches or over rockeries.

The sides of the house carry vines of *Clytostoma*, *Bougainvillea*, Passion-flower, and the double white Lady Banks Rose, now in flower, which set off or frame the lecture hall.

KENNETH R. BOYNTON.

STANDARDIZED PLANT NAMES [1]

About six years ago the American Joint Committee on Horticultural Nomenclature, authorized by six of the largest associations interested in the plant or planting trade activities, in coöperation with eight well-known flower and plant societies, began the compilation of a list of plant names, wherein would stand one approved scientific name and one common name for each plant entering into the horticultural trade.

Prepared by Mr. Frederick Law Olmsted, Mr. Frederick V. Coville, and Mr. Harlan P. Kelsey, the working sub-committee, this list is now published in book form, containing, as outlined in a circular of the committee, 548 pages of over 45,000 entries, giving the names selected and the synonyms, together with official variety lists of special groups such as Irises, Peonies, Roses, Dahlias, and Fruits.

From the preface of the volume it is learned that the purpose was to make buying easy, by agreeing arbitrarily on one name for each plant, to eliminate the confusion of common names, of names for hybrids and varieties, to establish a foundation of such, and to standardize in respect to many other problems. With a definite list agreed upon, printed, and distributed, and now an established fact, a long desired standard for plantsmen to use is here. It is the lowest common divisor, or mean, as you please, for all to use on common ground.

Privately, or with boon companions, one may still follow his own inclinations as to either common or scientific names; publicly he should follow this standard.

To the committee who worked up this list we owe much; their publication should be of great use to all plant-lovers.

KENNETH R. BOYNTON.

[1] Published by the American Joint Committee on Horticultural Nomenclature; Secretary, Harlan P. Kelsey, Salem, Mass.

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NOTES, NEWS, AND COMMENT

Dr. and Mrs. N. L. Britton returned to New York on March 25 after a two months' visit to Porto Rico and St. Thomas.

Mr. R. S. Williams, Administrative Assistant of The New York Botanical Garden staff, has been elected President of the Sullivant Moss Society.

Dr. W. A. Murrill, Supervisor of Public Instruction, returned on April 9 from his expedition to South America, where he made stops in Argentina, Uruguay, Brazil, and British Guiana.

Dr. John K. Small left New York on March 17 for another one of his botanical pilgrimages to Florida. He was joined there for about two weeks by Professor Frederic S. Lee, President of the Board of Managers of The New York Botanical Garden.

Dr. L. Herman Knoche, author of a scholarly monograph on the flora of the Balearic Islands, was a visitor at the Garden on March 20. Dr. Knoche has spent nearly twenty years in botanical studies in France, Spain, Germany, Scandinavia, Spitzbergen, the Balearic Islands, the Canary Islands, and northern Africa. He will now resume residence in his native city, San José, California, and will take up again his studies of the flora of California.

Professor Jean Massart of the University of Brussels, accompanied by Mme. Massart, visited the Botanical Garden on March 12. Later in the day he gave a lecture, illustrated by lantern-slides, at Columbia University, on "A Botanical Trip through Brazil." On the evening of March 11, he addressed the Torrey Botanical Club on "The Internal Sensations of the Norfolk Island Pine (*Araucaria excelsa*)." His visit to the United States will take him to California and to other centers of botanical interest.

Dr. Charles Thom, mycologist in charge of the microbiological laboratory of the Bureau of Chemistry, Washington, D. C., spent a day recently in the mycological herbarium of the Garden for the purpose of determining the identity of one of the mushrooms which has been found to be of economic importance. In addition to his official duties, Dr. Thom is making a detailed study of the Aspergillales, one of the groups of lower fungi, for the *North American Flora*. For several years he was in charge of the cheese investigation for the Department of Agriculture with special reference to the ripening of cheeses through the action of fungi.

Professor H. H. Whetzel of Cornell University recently spent a day at the Garden discussing plans for a mycological collecting trip to Porto Rico in June. Professor Whetzel will be accompanied on this trip by Dr. F. D. Kern of Pennsylvania State College. Especial attention will be given to parasitic fungi, including the rusts, which have been quite thoroughly worked for the island. An effort will be made to cover those parts of the island not before touched by mycologists, and the results will be available for the "Botany of Porto Rico and the Virgin Islands" being prepared by The New York Botanical Garden and The New York Academy of Sciences.

Meterology for March: The total precipitation for March was 1.21 inches, of which 0.15 (1.5 inches snow measurement) fell as snow. The maximum temperatures for each week were 54° on the 10th, 46° on the 13th, 61° on the 23d, and *67° on the 29th.* The minimum temperatures were 26° on the 8th, *22° on the 15th,* 26.5° on the 20th, and 29° on the 25th.

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Greenhouses, containing thousands of interesting plants from America and foreign countries.

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THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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DESCRIPTIVE FLORA OF PORTO RICO AND THE VIRGIN ISLANDS

TO THE SCIENTIFIC DIRECTORS OF THE NEW YORK BOTANICAL GARDEN:

Gentlemen.—Our investigation of the vegetation of Porto Rico and the Virgin Islands in coöperation with the New York Academy of Sciences, the American Museum of Natural History, and the Geological and Anthropological Departments of Columbia University, as a part of the Scientific Survey of that region commenced by the Academy in 1913, and cordially aided by the Insular Government of Porto Rico and by the United States Naval Government of the American Virgin Islands, has reached a stage of completeness that warrants the publication of the descriptive flora, presenting detailed descriptions of the native and naturalized species of plants, with notes upon those cultivated for use or for ornament and upon the economic products of both native and exotic species. These documents will require volumes five, six, and seven of the Survey reports, each volume to be composed of about four parts. The first part of the fifth volume, commencing the descriptions of seed-bearing plants, written by me, assisted by Mr. Percy Wilson, was issued August 10th, 1923; the second part was issued January 10th, 1924; the third part is in press; the fourth part, to complete the fifth volume, is written; manuscript for the sixth and seventh volumes, prepared by several coöperating students, is largely completed; publication may therefore proceed consecutively. Volumes one to four, inclusive, of the Survey reports are composed of documents, partly published, describing the geology and paleontology of the islands; volume eight is planned for

the commencement of the zoölogical reports and to be followed by volumes devoted to archaeology and anthropology. All parts and volumes are published, or to be published, by the New York Academy of Sciences.

With your permission, I was absent from the Garden during the period from January 26th to March 25th, 1924, continuing botanical studies in Porto Rico, St. Thomas, and St. Croix and obtaining specimens for the increase of our collections, aided by Mrs. Britton. These observations and specimens have increased the accuracy and completeness of the descriptions. Attention was concentrated upon the observation of rare or little-known species, requiring visits to widely separated localities. In Porto Rico especial attention was given to several typical areas little changed by humanization. Among these may be mentioned the southern shore of Laguna Tortuguero, a large fresh-water lake near the northern coast, and the extensive areas of fine white sand adjacent, frequently referred to in preceding accounts of exploration, and a Mecca for all naturalists, resident or visiting, the flora of this district being highly characteristic; it is most desirable that at least a portion of this region be set aside as a nature reservation. Our studies here during three visits were in company with Hon. Carlos E. Chardon, Commissioner of Agriculture and Labor; Mr. W. P. Kramer, Chief of the Forest Service; Professor Mel T. Cook, Botanist and Plant Pathologist of the Insular Agricultural Experiment Station; Professors E. C. Dale and J. S. Dexter of the Porto Rico University; and Mrs. C. E. Horne of the College of Agriculture and Mechanic Arts. Mr. Kramer was convinced as to the availability of the tract as a forest reserve and this disposition of it would effectively protect it as a nature reservation; we all earnestly hope that this may be accomplished; I have included a recommendation to this effect in the "Naturalists' Guide" soon to be published by the Ecological Society of America. Mrs. Horne executed a fine water-color painting of the endemic *Chamaecrista mirabilis*, a low, spreading Partridge Pea with beautiful yellow flowers. Here, on a wet sandy shore, first detected by Professor Dexter, we collected the yellow-flowered Bladderwort, *Stomoisia juncea*, recorded in 1806 as inhabiting Porto Rico, but not since observed there by botanists, and thus one of the prizes of the expedition. Here, also, in humus, in a

dense thicket, first seen by Professor Dale, was found the delicate low *Apteria*, of the Burmannia Family, hitherto known to us only from mountain forests, and in the same thicket Mrs. Britton found the little fern *Actinostachys pennula*, a genus and species new to Porto Rico. On the shore of another fresh-water lake nearby, the Laguna Rica, the rare West Indian Meadow-beauty, *Rhexia cubensis*, with fine purple flowers, was found by Commissioner Chardon. Many other native plants, previously studied and collected, were again observed.

From Mayaguez, where we enjoyed the delightful hospitality of Dean C. E. Horne of the College of Agriculture and Mechanic Arts and Mrs. Horne, a visit was made to the dry southern coast at Parguera, where Maguey Island, a limestone hill, was studied in company with our hosts and with Dr. D. W. May, Director of the Mayaguez Agricultural Experiment Station, and Mrs. May; Mr. T. B. McClelland, Horticulturist of the Station, and Mrs. McClelland; and with Professors H. T. Cowles, W. D. Durland, R. E. Danforth and Jean S. Whittemore, of the College of Agriculture, with members of their families, this excursion developing into a most enjoyable picnic. Maguey Island lies within the desert area of Porto Rico and is in a natural state, except for an extensive Arawak kitchen middens, evidenced by broken conch-shells and fragments of pottery; its vegetation includes many of the characteristic species of this arid region and these were studied with interest. One of the most attractive is the shrub *Ditaxis fasciculata* of the Spurge Family; it forms a very dense dark evergreen bush two or three feet high with many small bright white flowers among its small leaves and if cultivatable would be an attractive addition to ornamental garden shrubs. As observed by us it is strictly dioecious, staminate flowers only on some bushes, pistillate only on others. *Sebesten brachycalyx*, a small tree with large scarlet flowers, was a conspicuous floral feature of Maguey Island; this is already occasionally planted for ornament in Porto Rico and the Virgin Islands.

On the northern coast, at Sardinera, near Dorado, a private forest reservation, partly studied by us on former occasions, was visited in company with Miss Elizabeth Billings, of the Garden's Advisory Council, then visiting Porto Rico, and her friend Miss Wheeler. Protected areas of natural forest have

become so few in Porto Rico that each of them is highly prized by the naturalist; the Sardinera forest is almost at sea level, in moist sandy soil, and contains many magnificent trees and an interesting undergrowth of various species. It is reached by motor-car from San Juan in little over an hour and is thus the most available point for visitors to see an extensive primeval forest, the road passing along its borders for a considerable distance. Several kinds of ferns are abundant here, forming large colonies of great beauty; trees are well ornamented by epiphytes, both orchids and bromeliads, and many climbing vines ascend the trees to a great height; *Drypetes alba*, a tree of the Spurge Family, known to us hitherto only from the mountain forests, was detected here by Miss Billings.

Another patch of natural forest, of much smaller extent, also privately owned, occurs on a hillside near the filtration plant of the new aqueduct, south of Pueblo Viejo, a few miles from San Juan; it may be reached from the aqueduct road by a short climb, and is well worth a visit, for here may be seen, at an elevation of only about 100 meters, fine specimens of several kinds of the more important forest trees, now mostly restricted to the higher mountains, including Tabanuco (*Dacryodes excelsa*); Granadilla (*Buchenavia capitata*); Maricao (*Byrsonima spicata*) and Ausubo (*Mimusops nitida*).

The forestry operations of Porto Rico are now being advanced through enlarged facilities provided for the Forest Service Station at Rio Piedras, by the addition of land which permits the construction and planting of many more seed-beds. Many thousand young trees are now being distributed and planted both within the public forest reserves and on private land. It is expected that land for a Forest Service Arboretum will soon be provided at Rio Piedras, a very important addition, which will also be of great value to the University. There is still need of forest reserves along the higher parts of the central mountains, and demonstration forest plantations at several points along the main roads are desirable.

Many public and private gardens were studied in Porto Rico, containing exotic plants of beauty and of interest. We gratefully acknowledge information and hospitality from His Excellency, Governor H. M. Towner and Mrs. Towner; from Dr. D. W. May, Director of the Mayaguez Agricultural Experiment

Station, and Mrs. May; from Mr. R. Menendez Ramos, Director of the Insular Agricultural Experiment Station at Rio Piedras, and Mrs. Menendez; from Don Martin Aparicio of Adjuntas and Señora Aparicio; from Mr. J. H. Halliday of La Muda; from Mrs. Harris of San German; from Don Narciso Rabell of San Sebastian and Señora Rabell; from Mrs. R. B. Wilkinson of Bayamon; from Mr. and Mrs. E. G. Videll of Rio Piedras; from Mrs. William McKinley of Santurce; from the Misses Noble of Condado; Mr. Arthur Noble, the British Consul, and Mr. David Noble; while Don Carlos E. Chardon, Commissioner of Agriculture and Labor was continually solicitous for our welfare and progress.

Eight days were spent on St. Thomas, where Mr. Howard A. Meyerhoff was prosecuting geological and paleontological field work for the Scientific Survey of Porto Rico and the Virgin Islands, assisted by Mrs. Meyerhoff and by Mr. James P. Lee. We joined them on several trips to mutual advantage, collecting specimens, and taking notes on characteristic plants. At this time of year the most conspicuous floral features among wild plants are the Watafamma (*Sabinea florida*) of the Pea Family, a large shrub with elongated branches densely covered with showy lavender-colored flowers, and the Karrebesu (*Pictetia aculeata*) of the same family with bright yellow flowers, both relatives of the northern Locust trees; *Brunfelsia americana*, a shrub of the Potato Family with large salverform white flowers fading yellow, often planted for ornament in tropical gardens, was locally abundant; *Cienfuegosia heterophylla*, a low herb of the Mallow Family, with pretty cream-colored flowers, each of the five petals delicately brown-pencilled at the base, was abundant at Paradise Bay.

The botanical and horticultural features of Louisenhöj, the beautiful estate of Mr. Arthur S. Fairchild at about 800 feet elevation on St. Thomas, were studied again with great interest and high appreciation. Here he has brought together during the past few years a notable collection of plants, now including several hundred species, many of them not hitherto cultivated in the West Indies; his records of the time of planting, the sources from which they have been obtained, and their subsequent growth, are very important, and he has generously placed these records at our disposition, thus very materially increasing the

information for use in our investigations. His experimental work in the germination of the seeds of trees at this point, and his plantations of tree seedlings are serving to demonstrate the practicability of reforesting the hills of St. Thomas, still one of the most evident needs of the Virgin Islands.

With Mr. Fairchild we went to Magen's Bay and to other places on the northern side of St. Thomas, which, with its greater rainfall, is more luxuriant than the drier southern slopes, but on account of the poor roads, is seldom visited; improvement of existing roads, to make them traversable by motor-vehicles, would develop St. Thomas into a tourist island of great attraction, the views from numberless points being superb, but now, alas, practically inaccessible except on horse-back or on foot; and an elaborated system of good roads could not fail to be of advantage in other ways.

Other St. Thomas gardens visited with interest and profit were those at the Anglican Church, developed by the Reverend George Alexander Griffiths; that of Mr. and Mrs. Axel Holst; and that of Bluebeard's Castle, through invitation of Mr. H. Nies, and we are grateful to these friends for information and for delightful hospitality. At Bluebeard's Castle we enjoyed a wonderful floral display in a magnificent vine of *Petraea volubilis*, grown on a trellis, covered with clusters as long as one's arm of beautiful violet-purple flowers. It is most desirable that this elegant vine be brought into wide cultivation in tropical gardens.

During part of our time on St. Thomas we enjoyed the company of Mr. O. W. Barrett, Agricultural Adviser of the Porto Rico Government, and Mrs. Barrett; they were awaiting a steamer to take them to Dominica on an important horticultural errand, and a valued opportunity was thus afforded for discussion of many plant problems. We highly appreciate aid and information from His Excellency, Captain Philip Williams, U. S. N., Governor of the American Virgin Islands, and Mrs. Williams, and from Commander William S. Zane, Government Secretary. Through kind permission of His Excellency, I crossed from St. Thomas to St. Croix, on the U. S. S. Grebe and spent a day there with Mr. J. B. Thompson, Director of the St. Croix Agricultural Experiment Station, and Mrs. Thompson, and noted the extension of work at that station during the past year. Of especial

importance is the experimentation with Sweet Potatoes, the most important root crop of tropical America; through interbreeding of three well-known kinds which flower and fruit freely on St. Croix, Mr. Thompson now has 253 kinds under observation, planted consecutively in a field over 500 feet long and some 200 feet wide, for convenient comparison, and the selection of types most valuable for cultivation. Mr. Thompson's herbarium collection of the plants of St. Croix is a valuable addition to the equipment of the Station and he has supplied us with duplicates of all his specimens for use in our investigations. We highly appreciate valued aid and information from Lieutenant Roy E. Barrett, U. S. N., Despatching Secretary of St. Croix.

Respectfully submitted,

N. L. BRITTON,

Director-in-chief.

STARCH-BEARING PLANTS [1]

To be strictly accurate, it may be said that virtually all green plants produce starch, but the plants here considered are for the most part only those in which the starch is so abundant and so easily removable that it has become an article of commerce, or in which fruits, seeds, roots, tubers, or other organs, crowded with starch, are important as articles of food.

Starch is a carbohydrate, somewhat related to the sugars, and manufactured by green plants from carbon dioxide gas taken in from the surrounding air by the leaves and other green parts, and from water taken up by the roots. It is formed directly or indirectly by the energy supplied by the sun's rays and acting through the minute bodies in which chlorophyl, the green pigment characteristic of most plants, is found. The first product of these microscopic chemical laboratories is, however, probably not starch but may be an unstable poison, formaldehyde, which is transformed so quickly that its presence is difficult to detect. The first stable carbohydrate to be manufactured is probably glucose and it is probably in this soluble form that it is transported to other parts of the plant either to be used immediately

[1] Abstract of a lecture given in the Central Display House of Conservatory Range 1, on Saturday afternoon, February 2, 1924.

as food by the plant itself or to be transformed into starch and stored up for future use. The starch is laid down inside of minute special organs of the cell protoplasm known as leucoplasts or amyloplasts and it collects in the form of microscopic grains of rather definite size and shape characteristic of the plant that produces them, so that by a microscopic examination of raw starch, experts are usually able to tell the source of the starch, whether it came from arrowroot, Indian corn, or some other plant.

Most of our principal farm crops consist of storage organs for reserve starch—starch which in the ordinary course of natural events would, after being transformed into sugar, be consumed in giving a start to an embryo plant or in starting fresh growth from a resting organ, such as a tuber.

In the case of wheat, the reserve starch is stored in the grains, which are the seeds or fruits, and unless man appropriates it to his own use, it normally goes to feed the embryo wheat-plant which is wrapped up in the seed. About 68% of the dry weight of wheat grains is starch. In the case of Irish potatoes, the starch is stored in the tubers, which are modified underground stems, and it normally goes to start and feed the young shoots that spring from the eyes of the potato. About 80% of the dry weight of potato tubers is starch.

Green plants are the real food-factories of the world and it is not too much to say that they are the only real food-factories of the world. Man may get a part of his food from the milk or flesh of a cow, but the cow gets her food from grass and from grains. A lion may live upon meat only, but that meat was built up from organic compounds manufactured by plants. Green plants make not only their own food, but also the food of the whole animal kingdom. And the principal form in which that food is stored is the compound of carbon, hydrogen, and oxygen which we know as starch.

The forms of starch that are most important as articles of commerce are derived from potatoes, wheat, Indian corn, and rice. In the case of the Indian corn, much of the "corn-starch" is transformed into glucose or "corn syrup" before reaching the consuming public.

The arrowroot or Bermuda arrowroot (*Maranta arundinacea*) yields a starch that has been and still is highly prized for culinary purposes, especially in the preparation of foods for children and

invalids. The plant is said to have derived its name "arrow-root" from the use of the juice of its root or rather rootstock by the Indians as an external application to wounds made by poisoned arrows. The plant is a native of the American tropics, but has been introduced into India and other tropical countries. In India, however, there is another related plant, *Curcuma angustifolia*, the East Indian arrowroot, that is also a source of starch.

In obtaining the arrowroot flour from the creeping, partially subterranean stems, the skin or bark and all discolored parts are removed, the rootstocks are then washed, pounded up in a mortar, or grated in one way or another. The resulting pulp is then washed, the coarser parts strained out, the water decanted, and the white sediment, on being dried out, becomes the arrowroot flour.

The Manihot or cassava plant is the most important source of starch in the American tropics and is, in fact, one of the principal sources of human food in wide areas of the tropics in general. Several varieties or species are in cultivation. There is some difference of opinion as to whether the cultivated forms represent more than one botanical species or are simply horticultural varieties of a single species. A German botanist has recently described fourteen new species or alleged species from Brazil, which seems to be the center of distribution of the existing forms of Manihot and may be the original home of them all. "Cassava" is properly the native name of the starch, meal, or bread, made from the root of the Manihot plant, but the name is often applied to the plant itself. Manihot is a member of the family Euphorbiaceae, the Spurge Family, and is therefore somewhat related to the castor-oil plant, which it somewhat resembles. It grows ordinarily to a height of from four to ten feet and has large handsome leaves. It has long fleshy roots, the size and weight of which depend, more or less, upon the age of the plant. The ordinary weight of a cluster of roots after one season's growth is from 5 to 10 lbs., but they often reach 20 or 30 lbs. or sometimes 50 lbs. in a single year. After two years of growth they may reach a length of six feet or more. The larger ones are difficult to dig unless grown in a light sandy loam. In Florida, where the growing of cassava is becoming an industry of importance, a light soil underlaid by a hard-pan is preferred, as the hard-pan

prevents the roots from going too deep to be conveniently dug up. In the larger cassava fields of Florida special hooks or pullers are used to remove the roots from the ground, but in the tropics the roots are commonly lifted by hand or with the aid of spades, forks, or sticks. The roots do not keep very well out of the ground and they are usually dug as they are wanted for use. The yield of cassava roots on an acre of ground naturally varies with the fertility of the soil and mode of culture, but eight tons to the acre is considered a good crop. About 70% of the dry weight of cassava root is starch, so that in starch content it ranks with wheat and potatoes, but the protein content is low, so that as a food it is comparable with the Irish potato rather than with wheat. In Brazil or in parts of Brazil and in some other parts of the tropics, cassava bread is the main staff of life for human beings and is also extensively used as food for domestic animals. Many forms are in cultivation in Brazil, but there and in the tropics in general, they distinguish between the "sweet" and the "bitter" cassava, the bitter being a strain that contains a dangerous amount of hydrocyanic acid or prussic acid, a deadly poison, and the sweet being a strain that contains little or no hydrocyanic acid. But the bitter contains also a larger proportion of starch, so is the more widely cultivated on that account. The poison, however, is easily washed out with water or driven off by heat, so, with proper care, there is little danger from using the bitter kind. In preparing the root for food, the natives of the American tropics, who appear to have used the plant long before Columbus discovered America, grate the root to a pulp, wash out or press out the poisonous sap, add a little salt, and cook over a fire, which drives out any remaining poison. The resulting product tastes a little like baked hominy or "grits," and with many people takes the place of our bread, corn cakes, and potatoes. In South America, the natives sometimes make from cassava a fermented beverage which Europeans have occasionally tasted and pronounced good, though the method of preparing it is somewhat repulsive. The cassava is chewed, chiefly by the women, and the cuds are ejected into a vessel of water, where the mass is allowed to ferment for some days. The chemistry of it is evidently the conversion of starch into sugar, by the action of the saliva and the subsequent breaking up of the sugar into alcohol and carbonic acid gas by the action of yeasts intro-

duced from the mouth or from the surrounding air. The product is sometimes boiled, which may remove some of the "kick" but may at the same time render the concoction more sanitary!

The product of the cassava root with which inhabitants of the United States are most familiar is the tapioca of commerce. The roots are ground and the pulp washed and strained by machinery, the white sediment is spread out on sheets of iron and heated, and the result, sometimes after being granulated, is the tapioca or "Brazilian arrowroot" of commerce, which has a considerable use as an article of food in the United States and Europe. A large proportion of the world's supply of tapioca now comes from Java.

The true Sago Palm, *Metroxylon Sagu*, is a true feather-leaved palm, which is a native of the East Indies. It makes a tree from 20 to 50 feet high, with a trunk a foot or more in diameter. The starch, which is extracted and forms the sago of commerce, is deposited in the soft, white, pithy interior of the trunk. At the age of about 15 years, the tree blooms and ripens fruit, consuming in the process all of the reserve starch in the trunk, and the death of the tree follows. To obtain the starch, the tree, just before it reaches the flowering stage, is cut down, the pith is ground or mashed and thrown into tanks of water. After repeated washings, the white sediment is strained, dried, and granulated by being pressed through sieves, and forms the commercial sago. Other kinds of sago, not always distinguished in the trade, are derived from another kind of palm or from palm-like plants belonging to another family, the Cycadaceae. Much of what is sold as sago is in reality tapioca, derived from cassava root.

Several species of *Cycas* and *Zamia*, palm-like plants and often called Sago Palms, though not real palms, but members of another family, the Cycadaceae, are sometimes used as a source of sago, which is derived from the starch deposited in the pithy or medullary interior of their trunks, as in the case of the true Sago Palm. These cycads, although they commonly furnish the leaves for "Palm Sunday," are really more allied to the ferns than to the palms. But they commonly look like palms and they pass for palms with the great non-botanical public. The Sago Palms are slow of growth and are not of much commercial importance as a source of starchy foods, but they have at certain

times and places played a part of some local importance in the diet of human beings.

In southern Florida there is a native *Zamia*, *Z. floridana*, sometimes known as the Florida Arrowroot, or by the Indian name of "coontie" that has a short thick stem and root that is richly stored with starch, which has been an important food for the Seminole Indians and occasionally for whites. These Zamias, like most of the other cycads, contain a poison that must be washed out before the starchy substance is eaten. Neglect to do this is said to have cost the lives of some of the United States soldiers during the wars with the Seminoles. There are now several small factories in southern Florida that are making the "coontie" flour.

The plant of the Indian turnip or calla family, known to botanists as *Colocasia esculenta*, known to the Hawaiians as "taro," known in Jamaica as "coco," in Porto Rico as "yautia malanga," in Barbados as "eddo," and in other parts of the tropics by various other names, is widely cultivated in the tropics and is in some places more important than cassava as a starchy food. In Hawaii, its importance as a crop is exceeded only by sugar-cane, rice, and pine-apples. With the native Hawaiians, it has long been the principal food crop. They are said to have more than 200 varieties in cultivation. Their famous *poi* is a starchy paste made from the taro. The plant has large handsome peltate leaves and is closely related to the "Elephant's Ear" of our gardens. It has a compact flattened or egg-shaped corm, or under-ground stem, resembling that of the Indian turnip and loaded with starch and with smaller quantities of fat and protein. The fresh corm has about twice as much starch and half as much water as the Irish potato. An especially desirable variety of the Hawaiian taro, known as the "dasheen" or "Trinidad dasheen" has recently been introduced into Florida, and northerners are urged to buy and eat it wherever it appears in the markets in order to encourage its cultivation. The South needs more substitutes for the Irish potato. Bulletins on the culture of the dasheen and recipes for its cooking have been issued by the U. S. Department of Agriculture.

In Cuba, Porto Rico, and other West Indian islands, plants of the same family but of another genus, the genus *Xanthosma*, with hastate instead of peltate leaves, are cultivated under the

names "yautia blanca," "yautia amarilla," etc., or sometimes simply as "malanga."

The sweet potato, *Ipomoea Batatas*, a member of the morning-glory family, and of the same genus as our cultivated morning-glories, is often found throughout the tropics, half wild or partially cultivated, but is nowhere else so extensively grown as in our southern United States. It has a twining or reclining vine like the morning-glory. The starch and sugar are deposited in the fleshy root. In the tropics the plant persists year after year and the natives commonly dig up a root or two when wanted, without injuring the plant. A starch or flour is sometimes made from the roots of the sweet potato.

The various varieties of yams, the fleshy, starch-laden roots of several species of Dioscorea, sometimes resemble sweet potatoes in general appearance, but the plants that produce them belong in quite a different family, the Dioscoreaceae. The yams are rather extensively used as food in the West Indies, especially by the negro population. There are white yams, yellow yams, Chinese yams, Indian yams, negro yams, and quite a variety of other yams. The vines are often allowed to run up on poles to prevent their rooting at the nodes, and forming many small roots instead of a few large ones. The Chinese yam was at one time recommended for general culture in the United States, but it was found that it commonly made its tuberous roots deep in the ground, sometimes at the depth of three feet, so that there were practical difficulties in digging it. The Chinese yam is hardy in the region of New York City, its roots lying so deep that they are rarely injured by freezing.

Rice flourishes in the low lands of India, Hawaii, and other tropical countries, but our domestic supply comes chiefly, if not wholly from our southern states. Rice-growing in our southern states has increased more than ten-fold in the last twenty years, the development of the industry in Louisiana, Texas, and Arkansas being especially notable. Rice, like wheat, rye and oats, is a member of the grass family, and the starch is deposited in the grains or fruits. Rice has a larger proportion of starch and less of protein than wheat and as a food it is more closely comparable with potatoes than with wheat. It is the one great source of food of large parts of India and China and of some other parts of the world. The ordinary rice plant is almost an aquatic and flou-

rishes best when grown on low moist lands, where it may be flooded in early stages of its growth. But there are also upland varieties that may be successfully grown on higher and drier soil.

MARSHALL A. HOWE.

BOTANICAL FEATURES OF LAKE PLACID

During a brief vacation in the latter part of last October, I was a guest at the Lake Placid Club in the Adirondacks and was fortunate in having perfect weather for the enjoyment of this most delightful region of mountain, lake, and forest.

The general elevation of the extensive Club grounds is about 2,000 feet, while the circle of noble mountains forming the horizon, from Whiteface on the north to Marcy on the south, rises to over twice that height, the elevation of Mt. Marcy being 5,344 feet.

The visitor from New York, although only a night's ride from home, must be prepared for a decided change, not only in the air but also in the trees and other vegetation, which is much more northern in character than that about New York City. He will notice first the great abundance of evergreen trees, such as balsam and spruce on the uplands and larch in the swamps. The conifers in general with their small leaves are fitted by nature to endure extremes of temperature and moisture without shedding all their foliage. The larch, however, is an exception and drops its leaves in the fall, like our common deciduous trees.

The Adirondack forests abound in hardwood timber trees, such as beech, yellow birch, and sugar maple; some of them very old and valuable from the standpoint of the lumberman, who regards them with envious eyes. At the time of my visit, many of the deciduous trees were bare, but enough autumn foliage remained to color the landscape and give very beautiful effects against the background of evergreens. The canoe birch and aspen were yellow; the wild cherry, Pennsylvania cherry, and mountain ash, red or orange; and the larch, yellowish-brown. The white pine also had a yellowish-brown tint because a certain percentage of its leaves were ready to fall and had turned brown. Evergreen trees, like the pines and spruces, do not keep their leaves indefi-

nitely but shed a few each year, thus remaining green at all times, while continually renewing their breathing and feeding organs.

A rather noticeable feature of the forests was the large number of evergreen herbs and ferns on the forest floor. The ground-pines and the American shield-fern, *Dryopteris intermedia*, were especially abundant, while shin-leaf, dalibarda, wintergreen, partridge-berry, and similar herbaceous plants formed attractive masses which were often rendered more effective by the presence of brilliantly colored fruits. I counted six different species of ground-pine: *Lycopodium complanatum*, *L. clavatum*, *L. obscurum*, *L. lucidulum*, *L. annotinum*, and *L. tristachyum*. Some of these are extensively used for Christmas decoration and the spores of the first two have furnished the Lycopodium powder for druggists and for stage effects. The yellow spores, which are very abundant, are full of oil and burn readily, making a brilliant light.

I noticed also the meadowsweet, the cucumber root, alum-root, Jack-in-the-pulpit, dwarf cornel, bush honeysuckle, and many other plants that were not evergreen but that could be easily distinguished by their dead leaves or their characteristic fruits. On a protected and sunny exposure near the Golf House, I found blue violets in bloom. The view over the golf links from this point was very beautiful. In a few weeks they would be covered with a mantle of snow, ready for tobogganing, ski-ing, and other winter sports, while the tennis courts would be turned into rinks for the skating experts.

Although I took many tramps in the vicinity and drove as far as Ausable Chasm, I saw very few animals or birds. A solitary hedgehog, a few red squirrels eating yellow birch seeds; snowbirds, chickadees, song sparrows, chippy sparrows, bluebirds, and robins about made up the list; and some of these were on their way south. The mourning-cloak butterfly, which hides away for the winter in hollow trees, was seen a few times flitting about in sunny places. Although the weather was fine, it was evident that animals had learned by experience what to expect in the Adirondacks during the latter part of October!

The morning after my arrival I walked out toward Cobble Hill, a small conical mountain 2,330 feet in height just north of the Club grounds. Passing through woodlands of balsam, spruce, pine, larch, yellow birch, sugar maple, and wild cherry,

I reached the base of the mountain and stopped in a grove of canoe birch to examine a small patch of the one-sided wintergreen, *Pyrola secunda*, which I do not often see. Then I began the climb through scattered large-toothed and small-leaved aspens and over rough sandstone rocks, which had been washed bare of soil by repeated rains since my last visit.

The view from the summit well repays the slight effort required to reach it. Looking back toward the south over the Club grounds, Marcy rises in the far distance with many splendid peaks near it; Mirror Lake and Lake Placid are to the right; and Whiteface is in the rear at the upper end of Placid; while immense forests stretch away in almost every direction. The top of the peak is so sharp that I found no difficulty in examining its vegetation in a comparatively short time, and many of the elements were such as are common on mountain summits.

On the sandstone rocks, I found the common grayish-green rock lichen, *Parmelia conspersa*, but none of the big black species, *Umbilicaria Dillenii*, which I passed as I came up. In the thin soil on the ledges, were patches of reindeer lichen (often called moss), the common hair-cap moss, and several smaller kinds of mosses which were not in fruit. One small patch of sphagnum, *S. capillaceum* (better known as *S. acutifolium*), filled a shaded depression between two rocks where rain water collected. On the summit of Mt. Marcy, which is quite extensive, there is considerable sphagnum and the number of species of plants found there totals about 200.

Fungi were scarce, consisting of one or two puffballs and a few small mushrooms growing among the hair-cap moss. I found three kinds of ferns, the bracken (already dead), the marginal shield fern, and the spiny shield fern, the last two being evergreen. Grasses and sedges were represented by several species. The common hardhack and pearly everlasting stood in dead clusters, still showing fruit, while the heart-leaved aster and orange hawkweed were conspicuous because of their characteristic basal leaves. Clumps of blueberry and red-fruited raspberry bushes filled the seams in some of the rocks, while a species of dwarf willow and the bush honeysuckle, *Diervilla trifida*, grew in other rocks.

One of the most interesting shrubs seen was the Labrador tea, which loves cool, moist situations in the north and may be readily

recognized by the abundance of rust-colored wool on the underside of the leaves and on the young twigs. The leaves are evergreen and astringent and have been used as a substitute for tea.

The most abundant shrub on the summit, however, and one that interested me greatly was the mountain holly, called in most books *Nemopanthus mucronata*. It grew in dense thickets and bore many small red berries which were very bitter. The few dead leaves that remained were elliptic in outline and mostly entire on the margin. There is a tree in the Alleghany Mountains also called mountain holly (*Ilex monticola*), which bears its berries in close clusters while those of *Nemopanthus* are borne on long stalks.

All of the trees on the summit of Cobble were, of course, dwarfed in size by the poor and shallow soil. Aspen and mountain ash were the most abundant, the former with golden-yellow foliage and the latter colored red or orange. I found also red maple, shadbush, moosewood, spruce, balsam, sugar maple, wild cherry, Pennsylvania cherry, pine, yellow birch, and canoe birch, although some of these were represented by only one or two specimens.

My chief interest was, of course, the fungi, of which I found a large number; but these will be discussed in *Mycologia*.

W. A. MURRILL.

SWAMPS, ANCIENT AND MODERN[1]

To the average person, swamps in the abstract usually mean little else than wet and disagreeable, or inconvenient features in a landscape, which ought to be drained and obliterated as soon as possible; and a swamp in the concrete is commonly regarded as a place to be avoided, on account of its probable accompaniments of wet feet, mosquitos, and general discomfort, according to the season.

To the observant naturalist, however, whether geologist, zoölogist, or botanist, almost any swamp is replete with objects of interest, and these often tell strange and unexpected stories when their significance is understood and correctly interpreted

[1] Abstract of a lecture given at The New York Botanical Garden, September 16, 1923.

The surface features of a swamp should be regarded as representing effects that are the result of causes whose records are preserved in the deposits and accumulations of organic and inorganic matter that form the peat, muck, and silt that lie beneath the surface. It is only within comparatively recent years, however, that the study of such material has been seriously prosecuted, but it is now recognized as a distinct branch of natural science, under the name telmatology (from the Greek *telma* = swamp or marsh).

As a general proposition it may be said that almost every swamp had its beginning as a body of water—a lake, pond, lagoon, slough, or cut-off from a river, etc.—which in the course of time became silted up, invaded by vegetation, and converted into swamp land. A swamp is, therefore, merely a stage in development, and by observing and studying a number of swamps almost every stage in development may be noted, from those that are represented by a body of water with a more or less wet or swampy margin, to those in which the marginal vegetation has encroached upon the aquatic plants and mingled with them, and finally to those in which the marginal vegetation occupies the entire surface area of the former body of water. This has been brought about in part by the deposition of leaves and other vegetable débris and in part by silt and sand washed in by streams or during rains, and by dust that has been blown in.

In any comprehensive study of the evolution of a swamp, specialized work is necessary. The botanist determines the species of plants that are found growing on the surface. The ecologist studies the vegetation as a whole—the way in which plants are distributed in zones or colonies, how they became established there, etc. The telmatologist studies the contents of the sub-surface deposits and from these remains determines the characters of the vegetation that preceded the one now growing on the surface. And finally the geologist may study the topography and the character of the original lake or pond basin and weave the story of its origin and how water first came to occupy it.

When a modern swamp becomes an ancient one depends, of course, entirely upon the importance that we accord to the element of time in connection with its evolution. Swamps are in process of formation today just as they were during every

period in the past history of the Earth, and we can trace their records back through peat and lignite deposits of recent geologic times to the coal beds of the older periods. Every modern swamp—especially one in which peat is accumulating—may be considered as a potential coal bed.

The lecture was illustrated by lantern slides showing the characteristic surface features of upland swamps and lowland bogs and marshes; sections showing the evolution of a swamp from its original condition as a pond to a stagnant pool or bog; pictures of coal beds and the plants found in them; and ideal landscapes showing the characters of the vegetation that contributed to the coal contained in the rocks of different periods in the past history of the Earth.

ARTHUR HOLLICK.

CONFERENCE NOTES FOR MARCH

The March Conference of the Scientific Staff and Registered Students of the Garden was held in the Museum Building on the afternoon of March 4th.

Dr. Fred J. Seaver spoke on "The genus *Lamprospora* with especial reference to the distribution of species." The genus is one of the operculate discomycetes and is a rather large genus of, for the most part, very small plants. On account of the small size of the plants and the difficulty of getting type material and the unsatisfactory condition of such even when it can be had, a number of species collected about New York have been described from time to time as new. Most of these have very beautifully sculptured spores which furnish valuable diagnostic characters.

In 1912 two species were described as new and illustrated in *Mycologia*. Within a few months what was taken to be one of these was distributed from North Africa. Examination of the material showed that it was different, so it was redescribed and named in honor of the collector. Later, however, the same species was collected in New York, so that its known distribution is New York and North Africa.

One French species has been very commonly collected in the Bermuda Islands but so far as known has never been found on the mainland of North America. Of a number of species recently described from New York three have been collected in Australia but have not been recollected in America except by the author of the species.

The genus *Boudiera*, a closely related genus, is represented in America by a species collected in 1904 in Iowa. This species has since been collected twice in central Europe but has never been rediscovered in America. The type species of the genus *Boudiera*, originally collected in North Wales, has been found once in Germany and once in America. Just why such species of fungi should turn up on the other side of the world instead of in their first known haunts is a question which is very difficult to answer.

"Some Cultivated Plants of Unknown Origin" was then discussed by Mr. Kenneth R. Boynton. Plants cultivated commonly, but not definitely assigned to a certain locality or designated as surely descended from a known wild species are of several types; first, those economically important, known for centuries in domestic and agricultural life, but still of debatable origin. Even the manioc, sweet potato, peanut, tobacco, and yam, and others have furnished debate for anthropologists; and okra, dasheen, and melons of different kinds are still indefinitely located. There are also plants of ornamental use long cultivated, such as the tuberose (*Polianthes tuberosa*) still unknown in the wild. Plants growing in the Mexican tablelands approach it very closely, notably some which Dr. J. N. Rose has collected at various times, but definite relation between them has not yet been proved. Then there are the ornamental foliage plants, especially the variegated forms. *Alpinia vittata* is a striped plant grown for about 100 years, but its botanical relation is not correctly placed.

The long unplaced acanthads, *Eranthemum reticulatum*, *albomarginatum*, and *atropurpureum*, are placed in *Pseudoranthemum* now by Bailey and tentatively credited to Polynesia. There are many of the larger foliage plants. We have *Bihai geniculata*, one of our heliconias, that has not been properly assigned as yet. Most of these foliage plant cases are those long cultivated for

leaves only and which have seldom flowered. Many are of those brought from distant lands by the French, German, Belgian and English horticulturists during the foliage-plant craze. They paid little attention to records of their origin or native haunts. The identity of some formerly unplaced plants of garden culture has been recently ascertained, however. *Silene orientalis*, one of the most attractive of the Catchflies of our seed catalogues, is associated now by Professor Bailey with *Silene compacta* Fisch., from Eastern Europe and Asia Minor.

A. B. STOUT,
Secretary of the Conference.

PUBLIC LECTURES DURING MAY

The following is the program for the May lectures in 1924. The lectures are delivered in the Museum Building at 4 o'clock on Saturday and Sunday afternoons.

May 3. "Plant Collecting in Western Tibet"
Dr. Ralph R. Stewart.

May 4. "Plant Hybrids; Their Production and Uses"
Dr. A. B. Stout.

May 10. "Tulips" Mr. K. R. Boynton.

May 11. "Rambles among the Mountains."
Mr. Le Roy Jeffers.

May 17. "The Home of Linnaeus near Upsala."
Dr. W. A. Murrill.

May 18. "Scottish Wild Flowers." Mr. Herbert Muirhead.

May 24. "Reef-building and Land-forming Seaweeds."
Dr. M. A. Howe.

May 25. "Through the Mountains of Western Austria."
Dr. W. A. Murrill.

May 31. "Our Park Flowers." Mr. K. R. Boynton.

NOTES, NEWS, AND COMMENT

On April 5th, Mrs. N. L. Britton gave a lecture at the American Museum of Natural History in the regular Saturday morning course to the children of members. There were about 1200 children present and their interest and orderliness as well as

the fine lantern-service made the task both easy and pleasant for the speaker.

Dr. E. D. Clark, formerly a student at The New York Botanical Garden and Columbia University, we have recently learned, is now Director of the Northwest Branch of the National Canners Association, located at Seattle, Washington. Dr. Clark has published a number of papers on various phases of plant chemistry. From plant chemistry he soon changed over to animal chemistry and finally into administrative work, which is more remunerative. He still hopes to have sometime a chemical laboratory, where he can continue his investigations on plant problems.

The New York City Federation of Women's Clubs held a meeting Saturday, April 5th, in Conservation Week, at the New York Zoölogical Park, and planted an oak tree in memory of Margaret Olivia Sage, with an address by Dr. Hornaday. A poem on trees by Margaret E. Sangster was read by Mrs. Charles Cyrus Marshall. Mrs. N. L. Britton attended the luncheon and was assured by Senator Rabenold, Chairman of the Committee on Conservation of the Senate of the State of New York, that he was doing everything in his power to get an amendment passed including wild flowers in the Conservation Law of the State. Such a bill was since passed by the Senate, but was lost in the Assembly.

In connection with the Eleventh Annual International Flower Show, which was held at the Grand Central Palace during the week of March 17–22, an organization known as the Federated Garden Clubs of New York State was formed. Its main object is to make New York "the State Beautiful." Among its more specific purposes are to encourage civic planting, the restriction of unsightly billboards, the preservation of scenic and historic localities, and the creation of a spirit of cottage gardening such as prevails in England. The officers are: President, Mrs. John W. Paris, Flushing; Vice-presidents, Mrs. Fred Joel Swift, Nyack; Mrs. Walter Pierson, New Rochelle; Dr. Marshall A. Howe, N. Y. Botanical Garden; and Mrs. Clarence Lundt, Rochester; Recording Secretary, Mrs. Livingston Farrand, Ithaca; Corresponding Secretary, Mrs. Frederick T. Street, Flushing; Treasurer, G. Weldon Seager, Jackson Heights.

The California Big Tree, or *Sequoia Washingtoniana*, has been one of California's interesting features since first the groves of the mammoth "pine" were discovered by the white man. In recent years, however, notes the Forest Service of the United States Department of Agriculture, there have been indications that California's supposed supremacy in the exceedingly rapid rate of growth of this tree might be challenged. Oregon and Washington can already point with pride to the excellent growth that the Big Tree is making in these states. Specimens are commonly seen in many cities and towns west of the Cascades in both states, where they are making rapid growth. In Portland, Oregon, are several trees about 50 years of age that are 100 feet tall and several feet in diameter. To what extent the Big Tree is adapted to forest conditions in the mountainous regions of this district has yet to be determined. Trees in the 1912 plantations in the Crater National Forest in southeastern Oregon, at comparatively low altitudes, have already reached 10 feet in height. Plantings above 3,000 feet, however, have practically failed.

At the Savanac Nursery, near Haugen, Mont., where a growing stock of 10,000,000 forest plants is maintained and 3,000,000 small trees are produced annually for planting in the national forests, the delayed germination of western white pine seeds has been until recently a serious problem. This has now been solved by fall sowing, according to W. G. Wahlenberg of the Priest River Forest Experiment Station of the Forest Service. Whereas spring-sown seeds very frequently do not germinate until the second summer (the hold-over usually amounting to 50 per cent or more of the total number that do come up and sometimes as high as 90 per cent), fall-sown seeds come up early in the following spring and by the first of summer are well established. In one instance fall-sown seeds completed germination 15 days before adjacent spring-sown plots had even started. The best time for fall sowing appears from the results obtained to be the first half of September, or the last few days of August. The solution of this serious problem of raising the western white pine in the nursery comes as the result of six years of continuous investigations.

Dr. Johan Nordal Fischer Wille, professor of botany in the University of Christiania, Norway, died on February 4, in his 66th year. In December, 1914, Professor Wille accepted a commission from The New York Botanical Garden to collect freshwater algae in Porto Rico as a part of the natural history survey of that island. A preliminary report on the results of his three months of collecting there was published in the *Journal* of July, 1915. He was engaged in critical studies of his 2,000 Porto Rican numbers at the time of his death and it is understood that these studies will be continued by one of his pupils and colleagues. Professor Wille was especially well known for his treatment of the Green Algae in Engler & Prantl, Die natürlichen Pflanzenfamilien. He attended the 25th anniversary of the founding of the Missouri Botanical Garden in 1914, and in 1915, Washington University of St. Louis conferred upon him the degree of LL.D.

Dr. H. A. Gleason, of the Garden Staff, left New York for England on May 3, with the expectation of devoting three months to the study of South American plants in the herbaria of the Royal Botanic Gardens at Kew and of the Museum of Natural History in Paris. He will attend the British Botanical Congress, to be held in London in July.

Meteorology for April. The total precipitation for the month was 6.02 inches, of which 0.70 inch (7 inches by snow measurement) fell as snow, in the afternoon and night of the first. The maximum temperatures recorded for each week were 66° on the 4th, 71° on the 13th, 75° on the 14th and *75.5° on the 27th.* The minimum temperatures were *24° on the 1st*, 32° on the 9th, 32° on the 17th and 39° on the 27th.

PUBLICATIONS OF

The New York Botanical Garden

Journal of The New York Botanical Garden, monthly, containing notes, news, and non-technical articles. Free to members of the Garden. To others, 10 cents a copy; $1.00 a year. Now in its twenty-fifth volume.

Mycologia, bimonthly, devoted to fungi, including lichens; $4.00 a year; single copies not for sale. [Not offered in exchange.] Now in its sixteenth volume.

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Bulletin of The New York Botanical Garden, containing reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations. Free to all members of the Garden; to others, $3.00 per volume. Now in its twelfth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. Planned to be completed in 34 volumes. Roy. 8vo. Each volume to consist of four or more parts. 49 parts now issued. Subscription price, $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Memoirs of The New York Botanical Garden. Price to members of the Garden, $1.50 per volume. To others, $3.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. viii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of the New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the eleventh volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A **museum**, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An **herbarium**, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A **library** of botanical literature, comprising more than 34,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

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THE NEW YORK BOTANICAL GARDEN

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JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

THE FLOWERS AND SEED OF SWEET POTATOES
A. B. STOUT

TULIPS IN THE BOTANICAL GARDEN
KENNETH R. BOYNTON

THE FRANCES GRISCOM PARSONS FUND

CONFERENCE NOTES FOR APRIL

PUBLIC LECTURES DURING JUNE AND JULY

NOTES, NEWS, AND COMMENT

ACCESSIONS

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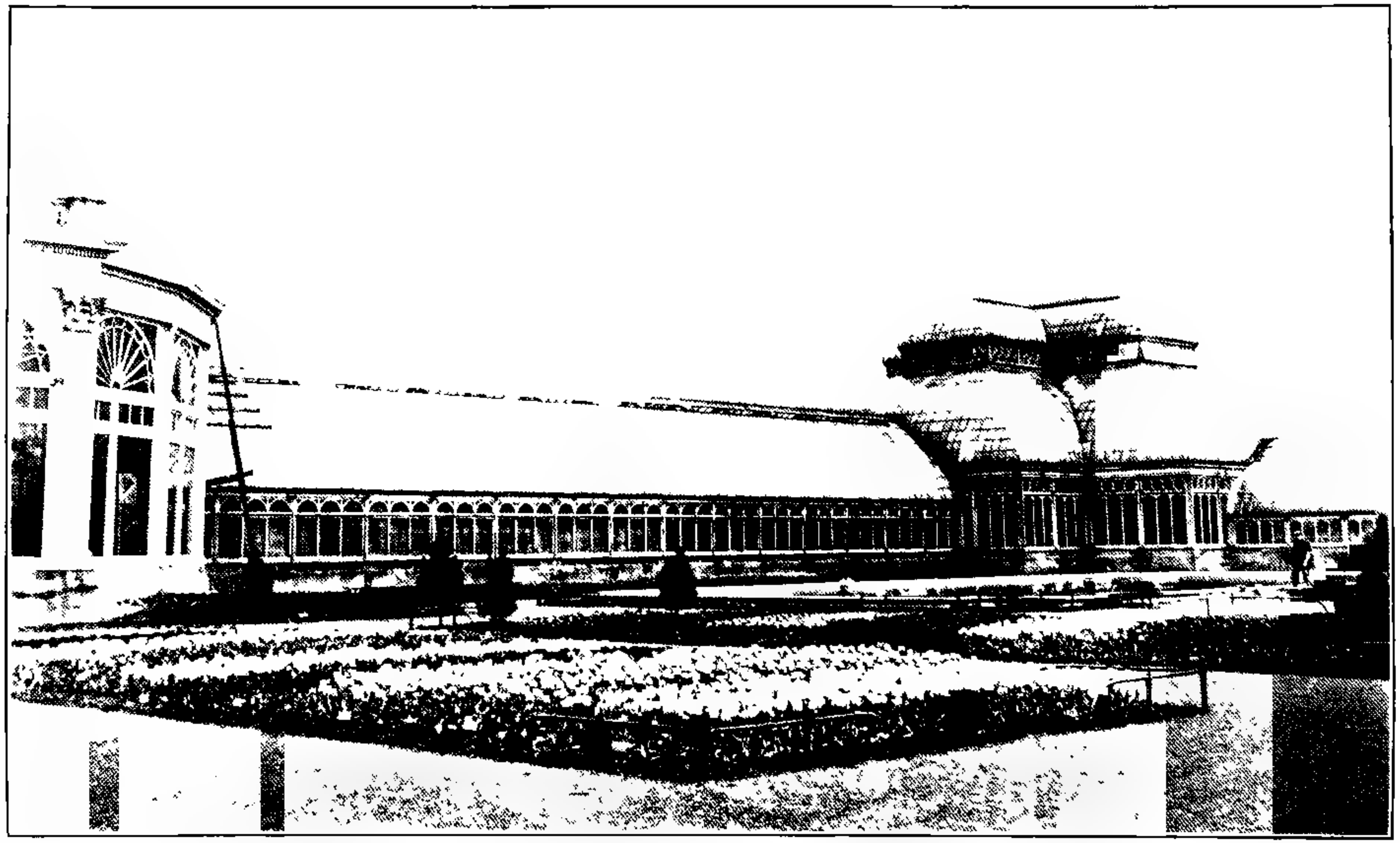

A part of the planting of approximately 40,000 tulips of Early, Cottage, and Breeder varieties in the court of Conservatory Range

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THE FLOWERS AND SEED OF SWEET POTATOES

In the rather voluminous literature pertaining to sweet potatoes there are few references to the actual production of seed. In general experience the sweet potato has been so decidedly barren and unfruitful that the Standard Cyclopedia of Horticulture (Vol. 6, page 3290, 1917) says of it "flowers and fruits are rarely seen." A still more recent volume, which is entirely devoted to "The Sweet Potato" (Hand and Cockerham, 1921) gives only one paragraph on the flowers and fruit as follows:—"*Flowers and seed.*—Although rarely producing flowers and less frequently maturing perfect seed in the sweet potato producing areas of the United States, occasionally a small bell- or morning-glory-shaped bloom, with a purple throat and white margin, may be noticed in commercial fields. Matured seed may be produced if the growing period is prolonged by the use of artificial means. These seeds, however, are unreliable for use in perpetuating varieties, as the resulting plants cannot be depended on as coming true to the mother plant. In fact, they may differ widely among themselves. This characteristic enables the production of new varieties by selecting strong and prepotent offspring."

Information regarding the flowering and the production of seeds by sweet potatoes is hence of general interest in its bearing on sterilities in plants and of a special and practical value to those who may wish to attempt improvement of this plant by breeding from seed. To this end the writer has attempted to summarize the published records of seed production in sweet potatoes and to supplement these with data obtained (principally in 1921 and 1922) through correspondence with persons who have had opportunity to make observations of this plant.

This information indicates definitely that seeds can very generally be obtained when plants are in good bloom, provided there is proper cross-pollination and suggests that the types of sterility operating are, 1st, the non-blooming condition, and 2nd, either the one-sided impotence of intersexualism or, what appears to be more probable, certain incompatibilities in fertilization.

Data Regarding Flowering and Production of Seed by Sweet Potatoes

It seems best to the writer to present the information obtained according to geographic and political areas and to quote various correspondents rather fully and exactly. It is hoped that this will be agreeable to all parties involved. It is, of course, readily understood that further observation on the part of some who are quoted would undoubtedly lead to a somewhat different statement.

New Jersey. Dr. Mel. T. Cook states to the writer that in his ten years' experience in New Jersey he has never seen blooms on the sweet potato but that growers have occasionally reported bloom. The densest acreage of sweet potatoes for the United States is in New Jersey.

Dr. Groth (see under Santo Domingo) writes of the sweet potato varieties, "Some bloom even in New Jersey, as I found when I had my experiments there in 1905–1906."

Virginia. "During the past season (1921) we had quantities of sweet potatoes to blossom in this state although I have no record of any instance where any seed were matured." A. G. Smith, Jr., in charge Vegetable Extension, Virginia Agricultural College.

Kentucky. "Such blooms are rarely seen in this section and I do not recall that I have personally seen them at all."—G. W. Mathews, Horticulturist, Kentucky Agricultural Experiment Station.

Oklahoma. "This plant occasionally produces blossoms in this state; however, up to date I have not been able to collect seed of the sweet potato in this state."—F. M. Rolfs, Horticulturist, Oklahoma Experiment Station.

North Carolina. "During the season of 1919 it was my experience to observe a profuse blossoming in the Norton Yam variety, which variety is one of thirty in our variety tests, and following this I made some provision for 'trapping' or saving any seed that might be produced. Out of possibly two hundred

blossoms kept under fairly close observation all but six resulted in nothing but husks. Six, however, produced seed, somewhat resembling that of the common morning glory and these seed were germinated early the following spring, or at least four of them germinated successfully while two did not. The last two seasons we have been on the alert for a recurrence of one of these profuse blossomings, however without result."—L. H. Nelson, Assistant State Horticulturist, North Carolina Experiment Station.

SOUTH CAROLINA. "Sweet potatoes do bloom quite frequently here and sometimes abundantly, but I have never seen them set seed."—H. M. Barre, Director of Research, Clemson Agricultural College.

GEORGIA. "The sweet potato does not generally make seed in this State, but it is reported by growers here and in Alabama that if they are grown in green houses for a long time they will blossom and produce seeds."—H. P. Stuckey, Director, Georgia Experiment Station.

FLORIDA. "The appearance of blooms on sweet potato plants here is nothing unusual, but it seems that no one has interested himself to follow the matter up and find out if seeds were formed." —Wilmon Newell, Director Florida Agricultural Experiment Station.

During October, 1922, Mr. A. C. Brown, Asst. Quarantine Inspector, State Plant Board of Florida, very kindly sent flowers of several varieties of sweet potatoes to The New York Botanical Garden. Owing to the distance of travel, the flowers arrived in such poor condition that no satisfactory study of the flower parts could be made.

ALABAMA. "We have seen only a very few blooms on sweet potatoes in the State of Alabama and I know of no case in which these blooms produced seed."—G. C. Starcher, Horticulturist, Alabama Polytechnic Institute.

MISSISSIPPI. "We very frequently have sweet potato blooms in our fields but it is very seldom that any of the plants have ever set seed. The writer has done considerable work in trying to get seed from the plants but to date no successful work has been done. A few years ago I took cuttings from vines that were blooming and put them in the greenhouse. They kept blooming continually but did not set seed due to their being infertile. There was very little pollen present as was determined under the microscope.

"H. C. Young of Georgiana, Alabama, has produced a couple of new varieties from seed. He has succeeded in getting three or four of the plants to set seed. I think that it is more a case of lack of pollen than a case of not blooming because several

times I have seen fields out in full bloom just like so many morning glories.

"If you can keep your greenhouse at from 60 to 90 degrees Fahrenheit you can get good plants of the following varieties: Nancy Hall, Golden Beauty, Dooley Yam, White Yam and Porto Rico. All these above-named varieties will bloom if given the proper attention, being careful to keep your greenhouse at not less than 90 degrees during the day and not less than 60 degrees at night. These plants will have to be left in pots for about six months to get the blooms. We get blooms from plants planted in April and left in the field until October." –J. C. C. Price, Professor of Horticulture, Mississippi Agricultural Experiment Station.

TEXAS. "I have had farmers tell me repeatedly that they had seen sweet potatoes blooming and, in some cases, producing seed, but I must admit that during the six years in which I have been connected with this institution in Texas, I have not noticed one single instance of either blooming or seed production of the sweet potato, and I have examined many a sweet potato field."

J. J. Tabenhaus, Chief, Division of Plant Pathology and Physiology, Texas Agricultural Experiment Station.

LOUISIANA. "Sweet potatoes rarely ever bloom with us and I have no knowledge of any seed having been produced in this state."—M. Hull, Sweet Potato Specialist, Louisiana Agricultural College.

NEW MEXICO. "Sweet potatoes never bloom in this part of the country. We grow a good many sweet potatoes but they are all propagated from the roots."—Fabian Garcia, Head of Department of Horticulture, New Mexico College of Agriculture.

ARIZONA. "Southern Arizona is a very promising sweet potato country; the acreage is increasing every year. On only one or two occasions, however, have I observed the plant in bloom, and I have never observed it setting seed."—J. J. Thornber, Director, Arizona Agricultural Experiment Station.

CALIFORNIA. Various growers of sweet potatoes in Southern California and horticulturists who have studied this crop in this area have personally reported to the writer that they have never seen flowers on any sweet potatoes grown in this area.

UNITED STATES IN GENERAL.

(1) "Dr. Evans of the States Relations Service bought and gave me a number of seed pods of two varieties of sweet potatoes, the seed of which had been sent from one of the Virgin Islands. This is the first sweet potato seed that has been brought to my attention. We have, however, flowered sweet potatoes a number of times, both in the field and in the greenhouse here in Wash-

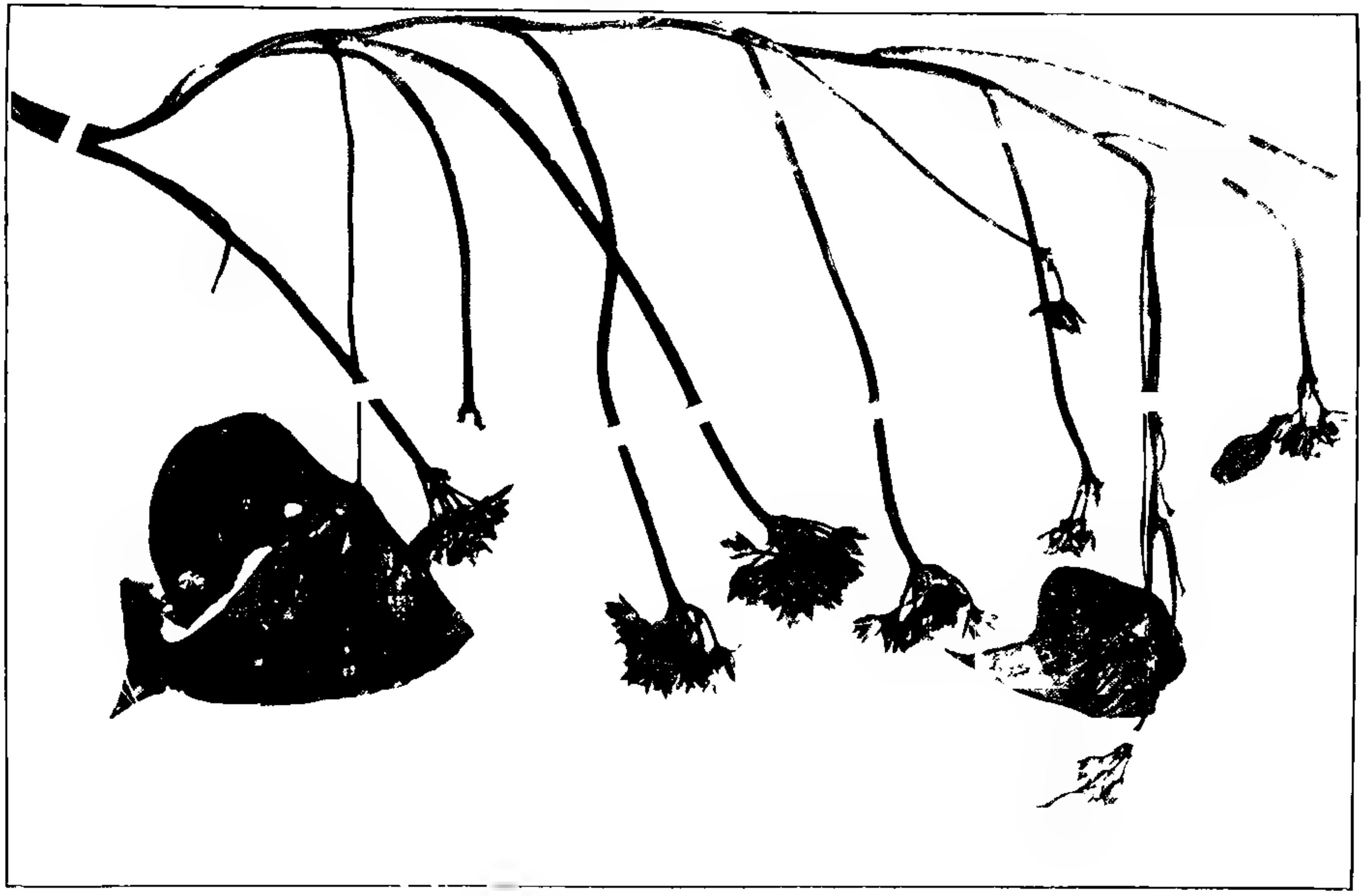
ington, and seed has been reported as having formed on sweet potatoes in southern Florida."—L. C. Corbett, Horticulturist in Charge, Horticultural and Pomological Investigations, U. S. Dept. of Agriculture.

(2) "On several occasions we have procured seed of sweet potatoes and have grown a large number of seedlings in an experimental way. We have also produced seed by cross-pollination in this country by making cuttings of the majority of the varieties of sweet potatoes and carrying them through the winter in pots in the greenhouse. They bloom profusely the second season and it is possible to produce seed. We have not, however, in any of our work produced a strain or variety that seemed to us to be sufficiently superior to our standard varieties to warrant our continuing its propagation. The sweet potato seeds rather freely in Porto Rico, Cuba, and elsewhere in the tropics, the tendency, however, of the seedlings so produced is to revert largely to types not considered desirable by our commercial growers. There is room, however, for some definite breeding work with the sweet potato, but this work should properly be done in Florida or at some other point where there is a long growing season."—W. R. Beattie, Extension Horticulturist, U. S. Dept. of Agriculture.

(3) "Several of the workers in the Southern sections, particularly Florida, Louisiana, Alabama, etc., state that the sweet potato blooms and seeds rather freely in their sections. In fact the claim is made that many of the varieties now being grown are chance seedlings, originating in the sections indicated above. The plant blooms as far north as Washington, D. C. We are doing considerable greenhouse work with the plant and hope by lengthening the growing season, it may be possible to induce seed formation.

"We have some seed sent in by Prof. J. B. Thompson of the Experiment Station at St. Croix, Virgin Islands. We will attempt to propagate from this seed in the hopes that some promising sorts may be secured."—James H. Beattie, Horticulturist, U. S. Department of Agriculture.

VIRGIN ISLANDS. (1) "I have been in the Philippines and Hawaii, also in the Island of Guam. In all these countries I have endeavored to obtain seed of the sweet potato at certain times but never succeeded. I am not sure whether in the plantings I particularly attempted to obtain seed from there was more than one variety or not. Here I obtained my seed from a planting where 3 varieties were planted side by side and seed was produced on all varieties. I noticed that bees were working on the flowers about the time they began to flower and some of the seedlings from Black Rock, for instance, show every evidence of having been crossed by the Big Wig variety. It is possible



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that all our seed may have resulted from cross-pollination." —J. B. Thompson, Agronomist in Charge, Agricultural Experiment Station, St. Croix.

(2) In the Report of the Virgin Islands Agricultural Experiment Station for 1922 by J. B. Thompson, it is stated that many plants in plots of Black Rock, Big Wig, and Key West yam varieties of sweet potato produced during 1921 "seed balls" which were collected and planted. "Unscarified seed was found to germinate very irregularly." It is reported that there was "a wide range of variation in leaf design, color and development of vine in the plants within the same family." A total of 283 seedlings were grown.

PORTO RICO. "Unfortunately there is very little information that we can give you relative to seed production in sweet potatoes. The profuse flowering tendency of some varieties, here in Porto Rico, has attracted my attention both at this Station and at the Experiment Station in Mayagüez. However, I have observed practically nothing in regard to the setting of seed by these blooms.

"In a recent letter, Mr. T. B. McClelland, Horticulturist of the U. S. Experiment Station, Mayagüez, states, that aside from his knowledge that many of the best varieties of sweet potatoes originated as seedlings, he has nothing further to advance in discussion of seed production of the sweet potato." —J. P. Griffith, Plant Breeder assigned to the improvement of sweet potatoes, Insular Experiment Station.

CUBA. "The sweet potato seeds freely here, in December, and this year I obtained some thousand seedlings. The seeds begin to sprout 24 hours after sowing. The seedlings are very healthy and strong. It is the first time I have grown seedlings of sweet potato." Written May 29, 1922, and later on June 15, 1922, the following: "In our sweet potato fields we got more seed where natural cross-pollination was possible because of the vicinity of other varieties."—Mario Calvino, Estación Exp. Agronómica, Santiago de las Vegas, Cuba.

SANTO DOMINGO. To Dr. B. H. A. Groth of Monte Cristi, Dominican Republic, the writer is indebted for seed of sweet potato illustrated in the accompanying figure and for much information regarding his observations on the flowering and seeding of this plant. The following are extracts from his letters.

(1) "Sweet potatoes bloom at any season of the year, and they set seed sparingly. The age of the plant at flowering time depends largely on the age of the cutting. If the root was planted, it will bloom at about 5–6 months, if vines are planted, as is always done in farm practice, the older vines may bloom at once, while others may delay for 4–6 months. I think all

varieties bloom in the tropics. Some bloom even in New Jersey, as I found when I had my experiments there in 1905–1906."

(2) "In March and April there are plenty of seeds set, in other months some, but not so many. The plants bloom less in the other months too, but there are usually some flowers at any time. The name of the variety I sent you seed from is, locally, "Venúa," but may be something else. We have about a dozen varieties growing together, and since bees work the flowers, there is always the possibility of cross-fertilization."

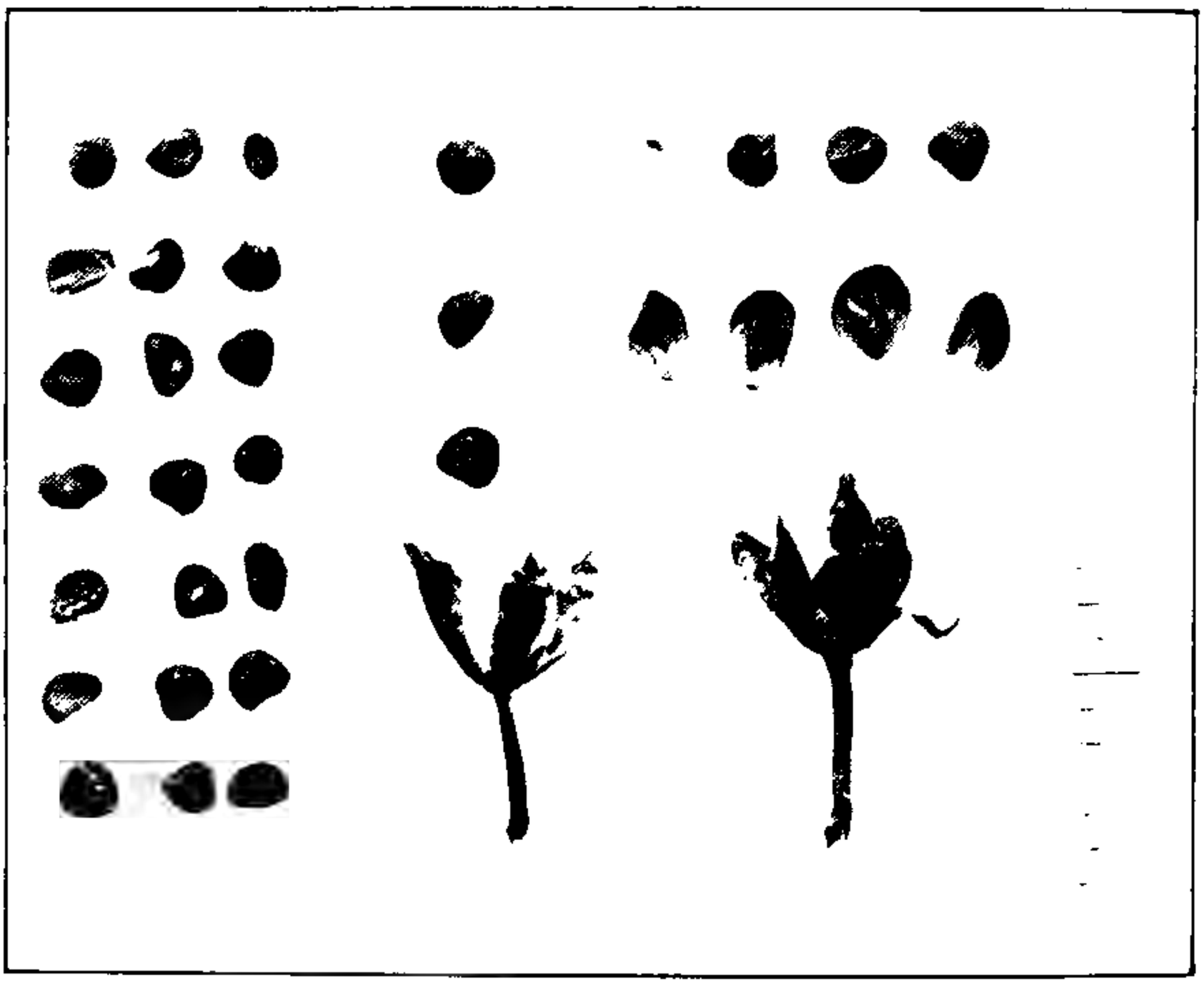


FIGURE 2. At l ft a group of seeds of the sweet potato. In the middle, three seeds from a single pod and below the dry calyx lobes with pod entirely removed. At the upper right three good seeds and one rudimentary seed from a single pod; below these are the four segments of the wall of the pod, while below is the remainder of the pod and the dry calyx.

BARBADOS AND ST. VINCENT. (1) The report of the Department of Agriculture for the year 1908 and 1909 lists 51 varieties of sweet potatoes being grown in tests since 1906 and states that 30 seedlings were obtained from seed of the variety Vincelonian, 11 from Six Weeks, and 16 from Kala. The report for 1910 mentions 17 seedlings under cultivation.

(2) "Some three or four years ago, when I was living in Barbados I had as a visitor Dr. S. C. Harland, of the Cotton Research Station, St. Vincent. He expressed some interest in this subject, and going no further than my small garden we found seed capsules in abundance, though neither of us had noted them before. On his return to St. Vincent, Dr. Harland found them abundant in his own garden, and raised some 26 seedlings, recorded in the Annual Report of the St. Vincent Agricultural Department for 1919, page 9. I have no reason to believe that this was in any way exceptional and from the great mixture of varieties that occurs in the fields I believe that seed production is pretty regular in the Windward and Leeward Islands."—Wm. Nowell, Assistant Director, St. Clair Experiment Station, Port-of-Spain, Trinidad.

TRINIDAD. "In Trinidad I am informed that the sweet potato does not seed. The plant is not so much at home in our humid climate as in the other islands and gives low yields. I think it probable, however, that seed could be found if looked for, but the present is not a suitable season to verify this belief." —William Nowell, Assistant Director, St. Clair Experiment Station, June 16, 1922.

HAWAII. (1) "In regard to the sweet potato blooming and setting seed in Hawaii I would state that there are a number of varieties and hybrids thereof grown by us on the University Farm which seed freely. On the other hand, not all varieties seed and especially during moist seasons when the foliage develops most luxuriantly and even the seeding varieties are less inclined to seed during wet years. When hand-pollinated a good many sorts set seed which would not seed of their own account."—F. G. Krauss, Professor of Agronomy, University of Hawaii.

(2) "The writer has been undertaking the improvement of sweet potato by sexual breeding for the past four years at this station. Approximately 700 seedlings were produced. We have about 70 varieties of sweet potatoes known by Hawaiian names and with the exception of a few they bloom profusely from November to April. Under Hawaiian conditions we find that the sweet potato seeds very freely with the exception of a few varieties which develop seed pods only after they have been artificially pollinated. We also find some varieties non-blooming."—H. L. Chung, Specialist in Tropical Agronomy, Hawaii Agricultural Experiment Station.

(3) "Except in case of a few varieties, the sweet potato blooms profusely in Hawaii from November to April."—H. L. Chung, The Sweet Potato in Hawaii, Bulletin no. 50, Hawaii Agricultural Experiment Station, 1923.

GUAM. "This station has conducted variety tests with practically all the local varieties of sweet potatoes but although a number of plants blossomed none of them produced seed." —Joaquin Guerrero, Assistant in Horticulture, Guam Agricultural Experiment Station.

PHILIPPINE ISLANDS. In The Philippine Agriculturist, Vol. 10, No. 5 (Dec. 1921) Dr. N. B. Mendiola reports on "Two Years of Sweet Potato Breeding." Seed was obtained from 9 varieties and 205 seedlings were grown. Artificial self-pollination failed to force the production of seed. The seed which was obtained came from flowers subject to open pollination by insects and there was opportunity for cross-pollination between varieties. The flowers are reported to be hermaphroditic but to vary somewhat in the length of the stamens.

In response to inquiry as to the conditions of seed production of the seedling varieties thus obtained, Dr. Mendiola has written the following: "No test was made of self-compatibility in the various seedlings obtained in the work. All that I can say at present in regard to this point is that from the first generation cuttings of various seedlings (7 are mentioned, including the two new varieties of apparently superior merit) we have obtained seeds without artificial pollination. I would add that the seedlings that produced these seeds were grown on neighboring plots in our plant breeding garden. We are now planting multiplication plots of these seedlings and we expect to study the compatibility of the seedlings in this new planting. I have a suspicion, however, that some of the seedlings I have are self-compatible."

JAVA. "If the planting of two sweet potato varieties are near to each other, cross-fertilization by insects takes place easily; under similar circumstances we have found a percentage of hybridization as high as 60. Autofecundation is quite possible. If a large planting is made of one sort, isolated from other varieties, the fruiting is not lessened."—From translation of a part of the Annual Report, Plant Breeding Station for Annual Crops, 1913, kindly supplied by P. J. S. Cramer, Director, General Experiment Station, Buitenzorg. This report also cites observations by Vallet de Villeneuve in 1837 to the effect that varieties which bloomed profusely but set no seed prior to the time of harvest could be induced to set seed if kept for several years on a poor soil.

NEW ZEALAND. "A very general tradition states that, not finding the kumara on their first arrival in the country, the Maoris made an expedition back to their old home among the Pacific islands to secure a supply for cultivation. That they brought back a large and well-assorted stock is evidenced by the number of varieties they possessed. Mr. Colenso states that

not less than thirty of these had come under his notice, while several of the old sorts were already known to be lost. All these varieties were well marked and permanent, and must have been produced before their introduction here, as, although occasionally flowering, the plant has never been known to seed in this country."—Archdeacon Walsh, in the Trans. and Proc. New Zealand Institute 35, page 13.

AUSTRALIA, QUEENSLAND.

(1) "From observation and numerous experiments carried out, the sweet potato apparently is not fertile to its own pollen and that to produce seed it is necessary to cross-pollinate by hand. I may mention that I have found the raising of seedlings a more difficult matter than the production of seed. I enclose herewith two photographs of seedlings." (One photo of six young seedlings, other of foliage and root of each of three seedlings.)—Report by C. B. Brooks, transmitted in letter by H. C. Quodling, Director of Agriculture, Queensland.

(2) "We are not aware that sweet potatoes have ever been grown in this State from seed prior to the experiment made last season at the Penal Establishment at St. Helena, which has proved eminently successful.

"From a report on the experiment by Captain C. Pennefather, Comptroller General of Prisons, forwarded to the Secretary for Agriculture, we take the following:—'Some vines raised from a few small sweet potatoes given to us by Mr. C. E. Hayes in 1898 were planted out in 1899, and in 1900 the Chief Warder noticed on the vines grown from these tubers several pods which contained two or three seeds each. These seeds were sown, but, although a great deal of trouble was taken, only eight seedlings were raised. A large number of plants came up, but most of them died off. This was in 1901. These seedling vines were planted out, and the result was very satisfactory. Owing to the drought last year (1902), which delayed the planting of the vines until November, the crop was not very productive, but the tubers grown are large and sound. A few lilac-colored stalks were found among the vines when the potatoes were being dug, and these were planted out. The result is, a potato different from the other in colour (being a bright yellow when boiled), and the shape of the leaf is different.'

"The favourable result of this experiment should prove of great interest and value to farmers who grow sweet potatoes for the markets. Of late large quantities of tubers grown from vine cuttings have proved to be diseased, and the continuous planting of cuttings of vines from the diseased tubers can but have the effect of perpetuating the trouble. The raising of a totally new variety, perfectly free from disease, should result in banishing the disease from the fields of those who can either

obtain healthy cuttings or raise new varieties for themselves." —From Queensland Agricultural Journal of Feb., 1904, page 90.

OTHER RECORDS OF SEED.

1. It is to be noted that what is evidently the first mention of fruit and seed of the sweet potato appeared as early as 1707 (see Sloane, Jour. Nat. Hist. **1:** 150, 151). Here, however, the capsule is described as having only one seed.

2. "The experiments carried on at the Botanic Station, Tobago, with seedling sweet potatoes have given good returns. The plants generally are different in growth and colour from those cultivated in the island and good varieties are expected from the selected seedlings." (Agricultural News **2:** 28.)

3. "The Curator of the Montserrat Botanic Station reports that about 100 sweet potato plants have lately been raised from seed and are now growing in the nursery at the station. In this connection it may be mentioned that the well-known and heavy-cropping 'Hen and Chickens' and 'Spooner' sweet potatoes are seedling varieties." (Agricultural News **8:** 124.)

4. "Attempts are being made at Buitenzorg to improve cassava and sweet potatoes by developing strains from seedlings. According to the Philippine Agriculturist and Forester, Vol. III, No. 7, sixty-three varieties of cassava have been tested during the last three years, of which the best twelve are listed by name. Of these eight are varieties obtained from Brazil, three are native Japanese, and one is a seedling. The use of seed with sweet potato promises results of surprising value." (Agricultural News **14:** 140.)

AT THE NEW YORK BOTANICAL GARDEN. Fifteen seedlings in all have been grown from the seed sent by Dr. Groth (discussed under Santo Domingo). Nine seedlings were grown in pots and in August were sent to the Office of Horticultural and Pomological Investigations of the U. S. Department of Agriculture. Cuttings from two of these, together with eight seedlings of belated germinations (ten in all) were grown in pots and kept in a greenhouse over the following winter.

On January 12, 1923, one of the plants grown from a cutting of one of the plants sent to Washington began to bloom continuing until thirteen flowers were produced. The anthers in nearly all cases dehisced readily and fully and the pollen was abundant with at least 90% of it well filled with granular contents. Eleven flowers were carefully pollinated by hand,[1] but in no case did fruit start to form. The vines of this plant died about May 1st, but previous to this date cuttings from it were rooted.

Old plants grown in pots during the winter and younger ones from cuttings were transplanted in the field and there grown

[1] These studies of pollen and the pollinations were made by Miss Hester M. Rusk, Assistant in the Laboratories, N. Y. Botanical Garden.

Plants derived from seed of the sweet potato, growing at The New York Botanical Garden as they appeared in early September, 1923. There is a vigorous vegetative growth, with some vines more than ten feet long, but with no formation of flowers. This condition of non blooming is characteristic of sweet potatoes over a considerable area throughout the more northern ranges of their culture.

during the summer of 1923. They all made vigorous growth (see PLATE 292), producing a tangled mass of vines but there was no formation of flower buds. These seedlings differed greatly

FIGURE 3. A pot-grown plant, from a cutting of a seedling sweet potato, blooming during January, 1924, in a greenhouse at The New York Botanical Garden. Fruit failed to start development, although careful pollinations were made by hand for all of the flowers.

in respect to shape of leaves, habits of growth and the color and size of fleshy roots.

In the autumn of 1923 cuttings were made from the ten clones and a total of 151 plants were grown in pots in a greenhouse during the following winter. All grew well, some making vines four feet in length. The 23 plants of the clone that bloomed

during the preceding winter did not produce a single flower. Two plants, out of fifteen, of another clone bloomed: one gave six flowers from Dec. 21, 1923 until Jan. 25, 1924 (see FIGURE 3), the other yielded five flowers from Feb. 1st to March 3rd. With one or two exceptions the anthers in all the flowers were fully developed and dehiscence was perfect. Pollen was abundant and under the microscope appeared plump and fully developed. Eight flowers were carefully self-pollinated, two opened and shed pollen by themselves, one flower was crossed using pollen of an Ipomoea blooming in the greenhouse at the same date. In every case the ovary promptly shrivelled and fell with no enlargement whatever.

During these two years of experience there were only three plants of two clones in bloom and there was no chance to make cross-pollinations between clones.

DISCUSSION AND CONCLUSION

The sweet potato has been propagated almost exclusively by vegetative means for a period of at least 400 years and in the more recent years its cultivation has been rather extensive. Also it is only the purely vegetative organs (the fleshy roots) that are used as food. The varieties have not been subjected to any sort of selection for production of flowers, fruit, or seed, as have many kinds of cultivated plants.

These conditions have given full opportunity for the persistence of any types of sterility which may have existed in the original seedlings from which the clonal varieties now in cultivation have been derived or of any types of sterility which may have developed later. It is not, therefore, surprising that the varieties of the sweet potato in cultivation today should exhibit types of sterility and should frequently fail to yield fruits and seeds or even to produce flowers.

A most obvious condition which enforces sterility of the sweet potato is the non-blooming habit. The plant is naturally adapted to a warm climate and a long growing period and its blooming is conditioned by this adaptation. Even its proper vegetative growth is practically confined to those sections where the average growing season is not less than 175 days and the mean summer temperature is above 72° (Geography of the World's Agriculture, p. 97). But the plant is able to thrive vegetatively and to yield good crops of roots when the environment does not favor the formation of flowers. Throughout a

certain area of the more northern range of its cultivation the sweet potato seldom blooms. In the tropics many, if not all, varieties bloom and often in profusion. This behavior is, it would seem, a response to environmental conditions, the most important external factors being, without doubt, temperature, length of growing season, length of day and intensity of light or perhaps a combination of some of these. This is suggested by the observations and results especially those of Professor Price for Mississippi, Dr. Groth for Santo Domingo and Messrs. James H. and W. R. Beattie of the U. S. Department of Agriculture. The effect of such environmental influences or the formation of flowers has long been recognized (see numerous earlier papers by Möbius, Vöchting, Klebs, Sachs and Goebel and the reports of more recent investigations by Setchell and by Garner and Allard).

Undoubtedly throughout the areas in which flowers appear sparingly and irregularly there may be more or less blasting of flower buds and some blasting of stamens only as indicated by the reports for Mississippi. But for most varieties, if not for all of them, the flowers seem to be perfect at least under conditions of favorable development. The sterility does not seem to involve a relative impotence of either pistils or stamens as in intersexes.

But in areas where flowers are readily and abundantly produced, fruit and seeds are most frequently not to be found. Several of the reports show that artificial self-pollinations have failed to effect fruit setting. There are several of the reports which indicate that when seed has been obtained there has usually been opportunity for cross-pollination. There appears to be some type of sterility operating which limits self-fertilization and which makes proper cross-pollination necessary for the formation of fruit. The individual flowers are open for a rather short time and the pistil and stamens in a flower seem to mature at quite the same time. The conditions suggest that there is functional or physiological incompatibility between the two kinds of sex organs involved in the processes of fertilization—a type of sterility very frequent in many hermaphrodite plants. Further observations of the flowers, with studies of the pollen and with tests by controlled self- and cross-pollinations are needed to determine more exactly the type of sterility present in the sweet potatoes.

It is, however, rather fully demonstrated that seed can readily be obtained on at least some varieties by cross-pollination. Breeding sweet potatoes from seed is possible and has very recently been begun in Cuba, in Hawaii, in the Philippines and also to some extent in the United States.

A. B. STOUT.

TULIPS IN THE BOTANICAL GARDEN

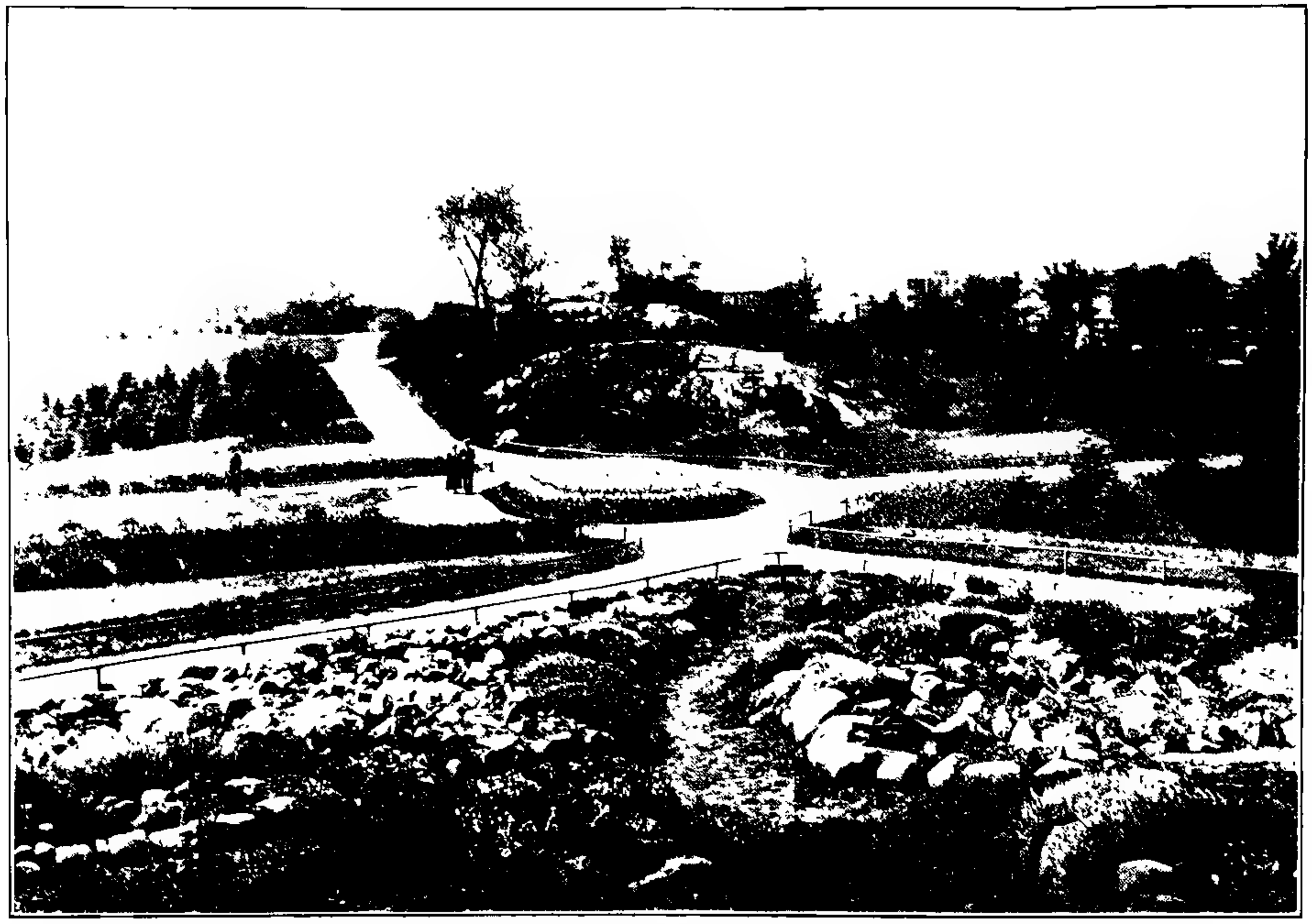
(WITH PLATES 291 AND 293)

Once more the Garden is indebted to Holland for one of the most brilliant floral displays ever seen in New York. The last week of April, the month of May, and the first of June saw the results of planting some 80,000 tulips, sixteen cases, of the well-known "Dutch Produce" received here last November, the gift of the Holland Bulb Exporters Association, arranged by Mr. H. J. Arentshorst, President of the Association, and transmitted through Messrs. Van Waveren and Sons.

These bulbs were planted last November, the Darwins in the Horticultural Grounds and the Breeders, Cottage, and Early types in the Conservatory Court. Flowers of Brilliant Star and Vermillion Brilliant, two bright reds, were fairly open on April 27, then followed color on Yellow Prince, Grand Duc, Van der Neer, White Hawk varieties, and Joost van Vondel varieties. Almost simultaneously with these Early Single sorts bloomed the eleven early double varieties, and they were enjoyed by thousands of visitors. Sunday, May 4th, they came in increasing numbers, and the flowers were in excellent shape. Early on the mornings of May 7 and 8, the heavy rain broke many flowers on El Toreador, Tournesol, Couronne d'Or, and one or two others of the heavy-headed doubles. For the annual inspection of the Garden on May 8th the early varieties were all in bloom and many of the late sorts planted against the conservatories.

The next three or four days were dark and showery but Saturday and Sunday, May 10th and 11th, saw nearly seventy-five varieties blooming at once in the court, and all of the visitors who could possibly be accommodated saw the display.

On May 16th a visiting day for members was held at the Darwin show. By this date nearly all of the varieties were open, but Sunday, May 19th, was the "peak" day for these Darwin tulips. They were visited by several thousand people from all



A part of the planting of about 40,000 tulips of Darwin varieties in the Horticultural Grounds, with the southwestern end of the Rock Garden in the foreground. Photograph taken May 22, 1924.

parts of New York City, probably a more typically metropolitan crowd than on other days. They were very appreciative, and their reaction to the colorful scene, while seriously interfering with the tulip-lovers studying groups of varieties, indicated new inspirations to the flower-lovers. They had their innings on Saturday afternoons and Sundays or on bright days generally. Fewer people came on all days and in all weather. At nine o'clock, daylight saving time, one evening, a gentleman was lighting matches to see colors and names. Amateur photography went on incessantly around tulip scenes, the children being the

FIGURE 4. Darwin Tulips, near the Southern Boulevard Entrance to the Horticultural Grounds. Photograph by Mrs. Wheeler H. Peckham.

subjects in most instances; as the center of things in general, the Baronne de la Tonnaye oval bordered with La Candeur was the usual background.

After holding off to accommodate the Saturday afternoon crowd of May 25th, rain fell from 6 o'clock until about midnight, accompanied by wind squalls. Flowers of such varieties as Bleu Aimable, Euterpe, Pride of Haarlem and Valentin were broken to some extent, and those which had been open longest, Valentin, Feu Brilliant, Wm. Pitt, Frans Hals, Melicette, and Europe, were somewhat burned after more than two weeks of constant duty. The next week, the last in May, saw only five or six varieties past and colors even more intense from the aging

flowers. Faust became an indelible blue black, Centenaire lost some of its carmine and touched almost a royal purple as did the rose-colored Edmee, Mme. Krelage, and Baronne de la Tonnaye. This day the early Cottages around the great Conservatory Dome commenced to lose their petals. These were *Gesneriana spathulata major*, Mrs. Moon, Ruskin, Carnation. Those on the northwest side of the Palm House, the Inglescombe sets, Scarlet Emperor, and Glare of the Garden, were still winning the admiration of all, being in magnificent condition as were also the bronze breeders. The 9,000 tulips planted among the growing peony plants gave entire satisfaction, especially King Harold, Centenaire, Scarlet Beauty, and Euterpe, not to speak of Clara Butt and Margaret, old standbys with practically every flower perfect.

TULIPS IN CONSERVATORIES COURT AT N. Y. BOTANICAL GARDEN

1924

Single Early Tulips

Brilliant Star
Calypso
Couleur Cardinal
Crimson Queen
Cullinan
De Wet
Flamingo
Fred. Moore
Golden Queen
Grand Duc (Keizerkroon)
Herman Schlegel
Hobbema
Ibis
Lady Boreel
Max Havelaar
McKinley
Pelican
Pink Beauty
President Cleveland
President Lincoln
Prince of Austria
Progression
Prosperity
Queen Flora
Rising Sun
Rose La Reine
Rose Luisante
Van der Neer
Vermillion Brilliant
White Hawk
Wouverman
Yellow Prince

Double Early Tulips

Couronne D'Or
Electra
El Toreador
Mr. Van Der Hoeff
Murillo
Peach Blossom
Schoonoord
Tea Rose
Titian
Tournesol
Vuurbaak

Cottage Tulips

Carnation
Dainty Maid
Gesneriana ixioides
Gesneriana lutea
Gesneriana spathulata
Glare of the Garden
Grenadier
Inglescombe Pink
Inglescombe Scarlet
Inglescombe Yellow
John Ruskin
Moonlight
Mrs. Kerrel
Mrs. Moon
Orange King
Scarlet Emperor
Sir Harry
The Fawn
Union Jack

Breeder Tulips

Apricot
Bacchus
Bronze Queen
Cardinal Manning
Chestnut
Don Pedro
Clio
Feu Ardent
Godet Parfait
Golden Bronze
Golden Spire
Indian Chief
James Watt
Jaune d'Oeuf
Klopstock
La Singulière
Le Mogol
Louis XIV
Lucifer
Marginata
Marie Louise
Panorama
Prince of Orange
Professor Schotel
Salomon
St. James
Turenne
Velvet King
Vulcain
Yellow Perfection

DARWIN TULIPS IN N. Y. BOTANICAL GARDEN

Afterglow
Anton Mauve
Anton Roozen
Baronne de la Tonnaye
Bartigon
Bleu Aimable
Centenaire
City of Haarlem
Clara Butt
Cordelia
Crepuscule
Diana
Dream
Duchesse of Hohenberg
Edmee
Ethel Roosevelt
Europe
Euterpe
Faust
Feu Brilliant
Flamingo
Frans Hals
Giant
Gretchen
Greuze
Homère
Isis
Jubilee
King George V
King Harold
La Candeur
La Fiancée
La Tulipe Noire
Lenotre

L'Ingenue
Louis de La Valliere
Madame Barrois
Madame Krelage
Marconi
Marnix van St. Aldegonde
Massachusetts
Massenet
Matchless
Mauve Clair
Melicette
Minister Tak Van Poortvliet
Mr. Farncombe Sanders
Mrs. Potter Palmer
Mystery
Orion
Painted Lady
Pensée Amère
Petrus Hondius
Philippe de Commines
President Taft
Pride of Haarlem
Prince of the Netherlands
Princess Elizabeth
Princess Juliana
Professor Rawenhoff
Reverend Ewbank
Scarlet Beauty
Sieraad van Flora
Sir Trevor Lawrence
Sophrosine
Suzon
The Bishop
Valentin
Victoire d'Oliveira
W. A. Viruly Verbrugge
Whistler
William Copeland
William Pitt
Zulu

KENNETH R. BOYNTON.

THE FRANCES GRISCOM PARSONS FUND

Some of the friends of the late Frances Griscom Parsons (Mrs. Henry Parsons), who was a pioneer in the establishment of school gardens in New York City and was for many years President of the International Children's School Farm League, have raised a fund of two thousand dollars to commemorate her work. This amount was given to The New York Botanical Garden on May 1, with the understanding that it shall be known as the FRANCES GRISCOM PARSONS FUND and that the income thereof shall be used for the corporate purposes of the Garden, with special reference to promoting interest in the subjects in which her own achievements were so notable.

Frances Griscom (born September 23, 1850; died September 29, 1923) was a daughter of Dr. John H. and Henrietta Peale Griscom of New York and a granddaughter of Rembrandt Peale, famed as a portrait-painter. After her marriage to Henry Parsons, a lawyer, she removed to the country and the following years were devoted chiefly to home duties, which included the upbringing of one stepchild and seven children of her own. Even in those busy years, she found time to assist in civic betterment by

organizing a kindergarten, a club for boys and girls, and a reading circle for young people, and by taking part in other village activities. At the age of 52, she returned to New York City and was much impressed by the lack of touch with nature exhibited by the average school child in the metropolis. In 1902 she started a children's garden in a vacant lot at 53d Street and North River. The idea progressed and attracted attention. A pupil of hers established a similar garden in Philadelphia and a daughter, on invitation, started school gardens in London. Mrs. Parsons' activities were noted by the City authorities and she became Director of the Bureau of Children's School Farms of the Department of Parks of Manhattan. Some of the principles that she successfully applied are the following:

Start education as the education of the race was started, in the open, close to nature, with real experiences.

The garden work is not to raise vegetables but to educate children. The main aim is not utility, knowledge, and skill, though those are all included, but development of character and appreciation.

All education should lead to right reactions. Therefore education is training, is an art, is development, is evolution. Knowledge is acquired by the way, and is a tool, but is not the main aim.

There are now three main centers of school garden work in Manhattan that were formerly under the direction of Mrs. Parsons. These are in Thomas Jefferson Park, 114th St. and Harlem River; DeWitt Clinton Park, 54th St. and North River; and Corlear's Hook Park, Jackson St. and East River.

Capt. Henry Griscom Parsons, a son of Mrs. Parsons, was Supervisor of Gardening Instruction at The New York Botanical Garden from 1917 to 1919. For a part of this time he was in charge of farming and gardening operations at various cantonments of the U. S. Army, with headquarters at Washington.

The list of subscribers to the Frances Griscom Parsons Fund includes the following names:

Alexander, Mrs. C. B.
Aldrich, Mrs. Margaret Chandler
Baker, Jr., Mrs. George F.
Billings, Miss Elizabeth
Britton, Dr. N. L.
Brooks, Miss Bertha G.
Bryce, Miss Mary T.
Butler, Miss Mary Marshall
Davies, Mrs. J. Clarence

Dodge, Mr. Cleveland H.
Dodge, Mrs. Cleveland H.
DuBois, Mrs. Eugene
Clarkson, Mrs. Banyer
Cross, Miss Mary R.
de Forest, Mr. Robert W.
de Forest, Mrs. Robert W.
Glenn, Mr. John M.
Graydon, Mrs. Clendenin
Hammond, Mrs. John Henry
Hitch, Mrs. F. Delano
James, Mrs. Arthur Curtiss
King, Miss Ellen
Kissel, Mrs. Gustav E.
League, The International Children's School Farm
League, The School Nature
Long, Professor Emilie O.
Low, Mrs. Seth
Luquer, Mrs. Lea McIlvaine
McAlpin, Mrs. D. Hunter
Milliken, Mrs. Gerrish Hill
Nichols, Mrs. J. W. T.
Orcutt, Mrs. C. Blake
Osborn, Mrs. William Church
Pennoyer, Mrs. Paul G.
Pond, Miss Florence Louisa
Popper, Mrs. Wm. C.
Robinson, Mrs. Douglas
Satterlee, Mrs. Herbert L.
Schuyler, Miss Louisa Lee
Schuyler, Miss Georgina
Scrymser, Mrs. James A.
Seward, Miss Alice D.
Smith, Jr., Mrs. R. Penn
Strauss, Mrs. Albert
Squibb, M. D., Edward H.
Terry, Mrs. John T.
Tuckerman, Mr. and Mrs. Eliot
Tuckerman, Miss Emily Lamb
Tuckerman, Miss Jane F.
Tweed, Mrs. Charles H.
Van Sinderen, Mrs. Howard
Wheeler, Mrs. Everett P.
Young, Mrs. A. Murray

Under date of May 1, 1924, Dr. N. L. Britton, Director-in-Chief of The New York Botanical Garden, sent the check for two thousand dollars to the Garden's Treasurer, Mr. John L. Merrill, with the following letter.

Dear Mr. Merrill:

I transmit herewith check for $2000 from the International Children's School Farm League.

At the meeting of the Board of Managers held April 17th, 1924, the following resolution was adopted:

RESOLVED: That the Managers of The New York Botanical Garden gratefully accept from the International Children's School Farm League two thousand dollars, payable May 1st, 1924, on account of the Frances Griscom Parsons Fund, such fund to be held open for subsequent contributions, and the interest to be used for any of the corporate purposes of The New York Botanical Garden.

This operates to establish another special fund, the income to be expended as subsequently directed by the Managers.

Yours truly,

N. L. BRITTON,
Director-in-Chief.

CONFERENCE NOTES FOR APRIL

The following abstracts are of the two reports presented at the Conference of the Scientific Staff and Registered Students of the Garden on the afternoon of April 2d.

"Galapagos and Cocos Island Mosses" by Mr. R. S. Williams.

The Galapagos and Cocos Islands are situated on the same submerged plateau at present about 1500 fathoms below the surface, and this plateau is separated from the American continent by a deeper channel which narrows down to only some thirty miles wide opposite Central America, while opposite the South American coast this channel is three or four times wider. If this plateau, as some believe, was ever elevated above the ocean, then there would be, we might suppose, the closest relation between the plants and animals of the islands and Central America, but such hardly seems to be the case, for while the majority of the species are not endemic as was once supposed, neither do they appear to be so closely related to Central American life as would be inferred by a separation of only 30 miles of water. Of the birds, several genera peculiar to the Galapagos group are most closely related to Hawaiian species. Of the 25 mosses so far collected from the Galapagos islands, about 25 per cent are endemic, and only one of these is found as yet on Cocos Island, the nearest land to them at present, being some 400 miles away. This moss, *Octoblepharum albidum*, being of almost universal distribution in tropical regions, is of no particular significance. Of the 13 species of mosses from Cocos Island, three appear to be endemic, or nearly the same proportion as in the Galapagos Islands. The other 10 species are known from Central and South America. Doubtless the greater part of the moss flora, especially of the Galapagos Islands, still remains to be discovered.

Under the title of "Notes on Algae," Dr. Marshall A. Howe showed specimens of the rarely collected *Nostoc parmelioides*,

sent in by Dr. J. M. Aldrich from rocks in a river at Stamford, Conn. It forms flat thalli about half an inch across and many of them are mined by the larvae of a fly. Specimens of this blue-green alga, found growing on submerged rocks in a river in Pictou County, Nova Scotia, by W. P. Fraser, in 1904, also have a larva in nearly every thallus.

The speaker exhibited also a peculiar unicellular green alga, apparently of the family Tetrasporaceae, occupying a layer in the gelatinous envelope of the eggs of the spotted salamander (*Ambystoma maculatum*), the material having been received in May, 1923, from Mr. S. C. Bishop of the State Museum at Albany.

Specimens and drawings of what appears to be a new species of *Pithophora*, a filamentous green alga, from Bermuda, were shown; also specimens of three apparently new algae from the Bahamas, representing the genus *Protoderma* of the Greens and *Chondrocystis* and *Dichothrix* of the Blue-greens.

Several calcareous or rock-forming algae were exhibited. In particular, a calcareous marl from a lake-bottom in Michigan, sent by Dr. E. M. Kindle of the Geological Survey of Canada, and in all probability built up by minute lime-secreting blue-green algae; a silicified fossil of the Ellis-Jurassic formation of Montana, sent in by Dr. Marcus I. Goldman of the U. S. Geological Survey, and apparently representing a forerunner of modern calcareous marine algae of the *Lithothamnium* group; and a specimen of the extensive deposit of an algal travertine (probably laid down by a species of *Phormidium* of the Blue-greens) that occupies an ancient beach of Quaternary Age bordering the Salton Sea Basin in California, the material communicated by Dr. Walter T. Swingle.

PUBLIC LECTURES DURING JUNE AND JULY

Below is the program for the June and July lectures of 1924. The lectures are delivered in the Museum Building, beginning at 4 o'clock on Saturday and Sunday afternoons. They are illustrated by lantern-slides and otherwise.

June 1. "The Bronx River Parkway." Mr. Jay Downer.

June 7. Walks and Talks in The New York Botanical Garden—I. "Birds." Mr. R. S. Williams.

June 8. "Wild Birds of New York City." Mr. S. H. Chubb.
June 14. Walks and Talks in The New York Botanical Garden—
II. "The Rock Garden." Dr. E. B. Southwick.
June 15. "Ethylene, or the Gas that Puts Plants and Animals to Sleep." Dr. William Crocker.
June 21. Walks and Talks in The New York Botanical Garden—
III. "The Museums and Herbarium."
Drs. J. K. Small and P. A. Rydberg.
June 22. "Ornamental Shrubs." Mr. Henry Hicks.
June 28. "Roses and Their Culture." Dr. M. A. Howe.
June 29. "Bolivian Roads and Trails." Dr. O. E. White.
July 5. "Wild Trees of New York City." Dr. W. A. Murrill.
July 6. Walks and Talks in The New York Botanical Garden—
IV. "Trees." Dr. W. A. Murrill.
July 12. Walks and Talks in The New York Botanical Garden—
V. "The Flower Beds." Mr. K. R. Boynton.
July 13. "How to Keep Plants Clean and Healthy During the Summer." Prof. H. Findlay.
July 19. Walks and Talks in The New York Botanical Garden—
VI. "The Library." Dr. J. H. Barnhart.
July 20. "Some Choice Flowering Trees and Shrubs."
Mr. Arthur Herrington.
July 26. Walks and Talks in The New York Botanical Garden—
VII. "Fungi and Insects." Dr. F. J. Seaver.
July 27. "Harnessing the Sun: Can Botanists Solve the Motor-fuel Problem?" Dr. M. A. Chrysler.

NOTES, NEWS, AND COMMENT

Another installment of Pittier's Venezuelan plants has been received for the herbarium, thus increasing the collections representing the flora of northern South America.

Professor H. M. Fitzpatrick of Cornell University spent a few days at the Garden recently in continuation of his work on the taxonomy of certain groups of the ascomycetous fungi.

The aquatics of the Garden have been augmented lately by *Philotria densa*, a water-weed of Argentina. This interesting plant was lately discovered in Mirror Lake, Florida, by Mrs. Katherine B. Tippetts.

A collection of species and varieties with several hundred seedlings and hybrids of day lilies (*Hemerocallis*) is now coming into bloom in the experimental plots. A wide range of color variations is to be seen in the flowers, some of which seem worthy of cultivation as new garden varieties.

The wool-sower gall is unusually abundant this season on the twigs of one of the small scrub oaks (*Quercus nana*) in the shrub collection just north of the Long Bridge. This very beautiful gall, made by tiny gall-insects, is large and globular in shape, nearly white delicately tinged with pink, and conspicuously woolly.

Mr. Clarence Lown of Poughkeepsie, N. Y., spent part of May 22 at the Garden, in consultation with Dr. Southwick relative to rock garden plants, and in arranging an exchange of species. We are indebted to Mr. Lown for many kinds of beautiful and interesting plants grown by him in his well-stocked rock-garden, and for advice and information.

Dr. A. B. Stout, Director of the Laboratories, spent three weeks late in May and early in June at the State Agricultural Experiment Station at Geneva, N. Y., studying sterilities in cherries, pears, and apples. The large collection of species and varieties of these tree fruits at Geneva affords unusual facilities for such studies. The cold and rainy weather then prevailing interfered somewhat with the work undertaken.

Of the 93 cases of books received from Geneva in August last, more than eighty have been opened, and most of their contents carefully examined. The work of incorporating them into the library necessarily progresses slowly, but more than three hundred items, comprising nearly eight hundred volumes and pamphlets, have already been listed among the library accessions in the *Journal*, and all of these are already on the shelves and fully catalogued.

The blight of the plane-tree is more serious this season than usual owing to the long period of rainy weather. Some of the trees appeared nearly dead early in June, because practically all their foliage was blighted, but other leaves will develop and the trees will be in full foliage again by midsummer. This disease

is caused by an inconspicuous fungous parasite, *Gloeosporium nervisequium*, present in the injured twigs and young leaves.

Dr. Frank D. Kern, Professor of Botany and Dean of the Graduate School of Pennsylvania State College, spent a day at the Garden discussing plans for a collecting trip tc Porto Rico. Dr. Kern and Professor H. H. Whetzel sailed on June 5 for a two months stay in the West Indies. Their time will be devoted to the study of the plant rusts of that region and they are expected to supply the manuscript on this group of fungi for the Botany of Porto Rico and the Virgin Islands.

Dr. Harold L. Lyon, in charge of Botany and Forestry at the Experiment Station of the Sugar Planters Association at Honolulu, visited the Garden in June, accompanied by Mrs. Lyon. He is especially occupied at present in reforestation operations on the slopes of the Hawaiian mountains and establishing collections of trees, shrubs and other plants on a reservation of about 400 acres between 500 feet and 2000 feet elevation. During his visit Mr. Boynton made interesting arrangements with him for an exchange of duplicate greenhouse plants for plants and seeds of characteristic species of the Sandwich Islands. The native endemic plants of Hawaii do not respond readily to cultivation, but we hope to have some of them grow.

Messrs. Bobbink and Atkins of Rutherford, N. J., have continued their valued coöperation by contributing over 800 rare plants this spring. The two hundred climbing roses given by them last autumn and planted at the bases of cedar poles in the northern part of the rose garden came through the winter with the loss of only three plants, all but these growing vigorously and most of them producing some flowers, but another year will be required for them to reach good development. It may be recorded that the cold spring has retarded the flowering of the rose collections by about two weeks, so that the maximum of bloom will not be reached until the last week in June or the first days of July. A representative series of single roses has been planted on the hill and slopes at the southern end of the rose garden.

The collection of native North American Iris is continually receiving additions from botanists interested in the study.

Plants of the more southern species are now flowering and Miss Eaton is painting the flowers of species additional to those that bloomed in the collection last year. Through the interest of Mrs. Wheeler H. Peckham, specimens have been secured from various localities throughout the United States. Mrs. W. K. Fishburne and Mrs. Dennis Auld of Pinopolis and Mt. Pleasant, South Carolina, respectively, have contributed material of the Thomas Walter species—botanically described in 1788—secured in the Walter region in South Carolina. Through their activities and the personal interest of Miss Laura M. Bragg, Director of the Charleston Museum, the identity and status of Walter's *Iris hexagona*, heretofore largely, if not wholly, misunderstood or misinterpreted, has been definitely ascertained. The solution of other problems in this much neglected genus awaits the flowering and fruiting of the various plants constituting our collection of native American iris.

Dr. J. N. Rose of the United States National Museum was at the Garden for about two weeks in June, studying the collections of the Cassia Family with Dr. Britton, in anticipation of the preparation of a monograph of the genera and species of this family (Caesalpinaceae) inhabiting North America and northern South America. These plants, represented in our northern flora by but few species, are very numerous in tropical and subtropical regions. The present study will include not fewer than 80 genera and 480 species to be described for "North American Flora" and as a contribution to the investigation of the vegetation of northern South America prosecuted by the Garden in coöperation with the National Museum and the Gray Herbarium of Harvard University. Most of the species are trees or shrubs, many of them elegant in flower, and some are of economic importance. The collections at the Garden taken with those of the National Museum include very nearly all the known species, and many as yet undescribed, and thus new to science.

Meteorology for May. The total precipitation for the month was 6.85 inches. The maximum temperatures recorded for each week were 73° on the 5th, *76° on the 17th*, 71° on the 24th and 75° on the 28th. The minimum temperatures were *38° on the 5th*, 43° on the 13th, 40° on the 23rd and 44° on the 31st.

ACCESSIONS

BOOKS PURCHASED FROM THE GENEVA BOTANICAL GARDEN, AUGUST, 1923, (continued)

BAKER, JOHN GILBERT. *Revision of the genera and species of the Asparagaceae.* [London, 1875.]

BARBEY WILLIAM. *Lydie, Lycie, Carie 1842. 1883, 1887. Études botaniques.* Lausanne, 1890.

BEGER, HERBERT K. E. *Assoziationsstudien in der Waldstufe des Schanfiggs.* Chur, 1922.

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Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

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An **herbarium**, comprising more than one million specimens of American and foreign species.

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THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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JOURNAL
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SEEDLING LILIES: A REPORT OF PROGRESS OF EXPERIMENTAL STUDIES WITH SPECIES OF LILIUM

In the studies of seed propagation of lilies, now in progress for several years at The New York Botanical Garden, three hundred and eighty-two different plantings of seed have been made and seedlings have been obtained and are being grown from twenty-nine different species. It is the aim of these studies to determine for each of as many species as possible the type of germination, the conditions favoring best germination, and the best methods of handling seedlings to obtain bulbs of flowering size and quality. Certain points of botanical interest and of practical value have been observed, and of these a preliminary report may now be made.

Sources of seed planted. Seeds have been obtained through the Office of Foreign Seed and Plant Introduction, U. S. Dept. of Agriculture, from various botanical gardens abroad, from correspondents, but mostly from controlled pollinations of plants grown at The New York Botanical Garden.[1] It is not, however, always an easy matter to obtain seed from plants, due to the very general occurrence among species of lilies of self-sterility from incompatibility in fertilization. A discussion of the behavior of lilies in this respect and of how seed may be obtained has already been made.[2] Efforts are being made especially to secure seed of species growing wild in Europe, in Asia, and in

[1] The purchase of bulbs from which these plants were grown was made possible by the financial support of Mrs. Mortimer J. Fox, whose assistance is gratefully acknowledged. In all these investigations the writer has been very ably assisted by Miss Hester M. Rusk.

[2] Stout, A. B. Sterility in Lilies, Jour. of Heredity 13: 369 373. 25 Ap 1923. Reprinted in The Gardeners' Chronicle, III, 74: 308–309. 24 N. 1923.

California, as this is apparently a most certain and satisfactory way of establishing such plants in culture. Studies of seed sterilities and of cross-breeding are being continued.

FIGURE 1. Lily seedlings. From left to right: *dauricum* × *elegans*, cotyledon above ground and carrying seed coat at its apex, first leaf develops soon; *tenuifolium*, with long slender cotyledon and three true leaves in stages of development; *regale*, cotyledon long and slender, first leaf not yet appearing; two seedlings of *speciosum*, one with first leaf, one with cotyledon only which remains in the soil; *tigrinum* × *Maximowiczii*, long slender cotyledon and first leaf; *Henryi*, cotyledon and first leaf.

FIGURE 2. Beginning their third summer, these lusty seedlings of *Lilium speciosum*, *L. Henryi*, and *L. croceum* × *L. elegans* (left to right) are getting ready to bloom. Such plants could well have been planted in the garden in the preceding autumn. These plants have been potted three times; first from seed pans early in the spring of 1922, second in the autumn of that year, and third in the autumn of 1923. They have been grown entirely in a cold frame.

Seed-sowing. Excellent results have very generally been had when seeds are sown as soon as they are fully mature—that is, when the capsules are splitting open and seeds are ready to fall out—or soon after they are collected. Seeds of several species

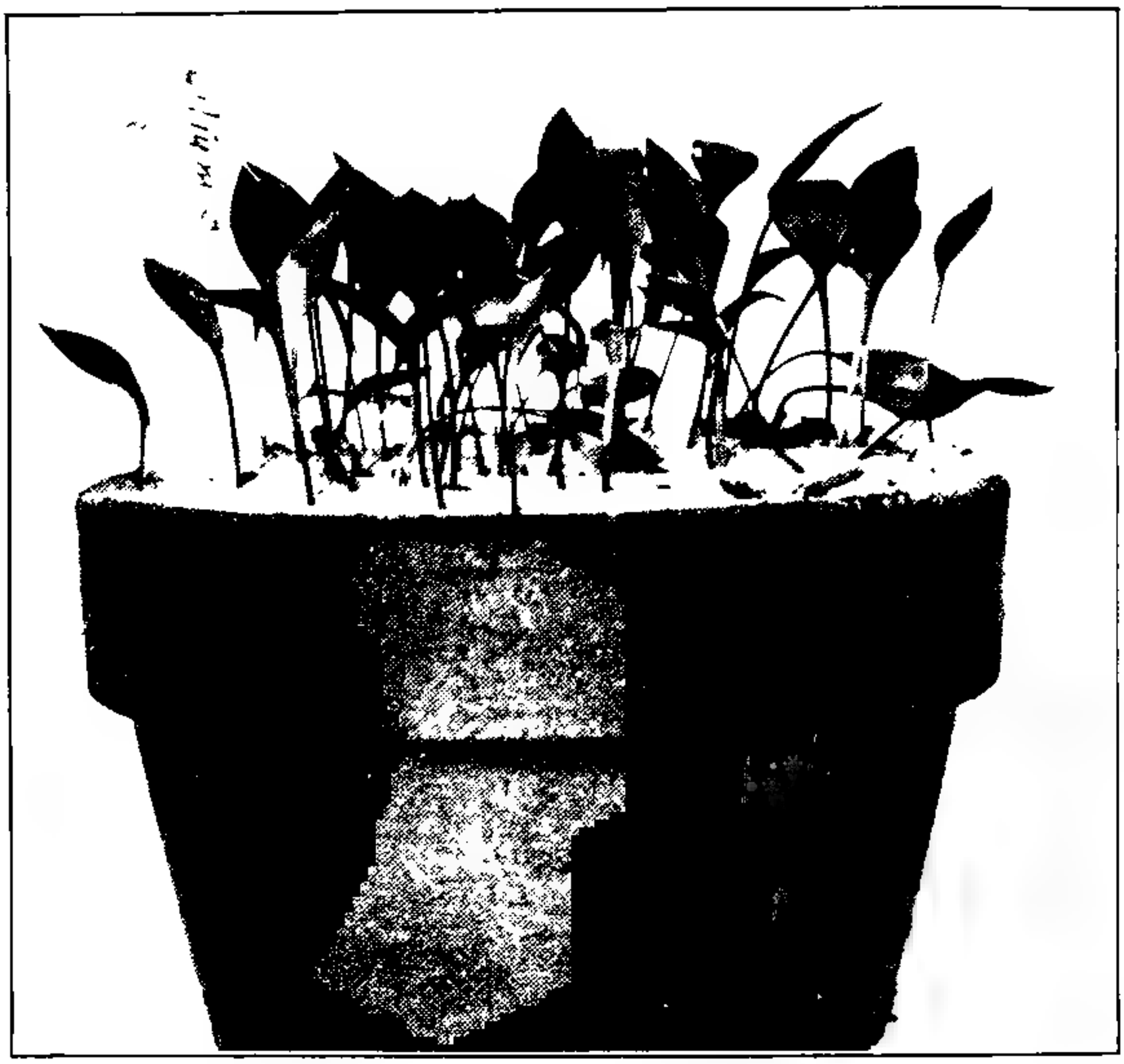

FIGURE 3. Seedlings of *Lilium Humboldtii*, a splendid tall-growing lily from California. The seed was sown in September and kept in a cold frame over winter. The cotyledons remain in the soil. The first leaf of each seedling, here shown, appeared in the spring following the planting of the seed. The seedlings are now ready for potting.

have been kept in a dry condition at room temperatures and planted in the spring following the collection, with excellent germination. In a few cases seeds kept in storage for an entire year before being planted have germinated well, but in other cases there has been no germination. From the general experience it seems best to plant seed not later than the spring following its collection.

Germination has been tested in different soils. A garden loam or its predominant use in mixtures with sand and humus tends to become somewhat compact, especially if the seedlings remain in the seed pan for a year. It has seemed that our best results have been had with mixtures of half sand and half decayed leaf mould put through a medium-meshed screen.

The seed is sown in earthen "bulb" pans of size suited to the number of seeds in each planting. The seeds are covered to a depth of about one-half inch. When the seed pans are placed in a cold frame they are sunk into the soil nearly to the level of the top. When placed in a greenhouse they are set in saucers and placed on broken stones either under the benches or upon them.

When seeds are planted in autumn there is very frequently quick germination both in cold frames and in a hot house. In some cases and particularly for certain species there has been a better and a more extended growth during the winter under greenhouse conditions. The autumn planting of seed of *L. canadense* has not hastened the appearance of the first leaf. In many cases, however, both under greenhouse and cold-frame treatment, seedlings from fall sowings of seed have become dormant during midwinter, have been repotted then, and have made a splendid growth during the following summer, with evident gain over spring planting. In certain seed plantings, the seeds have remained dormant for several months, even over one summer, when other plantings of the same species handled in quite the same way have given quick germination. Further tests are necessary to determine more specifically the further points regarding germination. In general, germination soon follows seed planting. But the development of succeeding leaves after the first one appears depends, evidently, somewhat on the species and somewhat on whether seeds are sown in autumn or in spring and on how the seed pans are treated.

Types of germination. There are two main habits of germination and subsequent growth of seedlings of lilies. For most species the cotyledon extends above the ground and becomes green; usually it is arching at first and then straightens up, sometimes carrying the seed coat up into the air.

In the second method of germination the cotyledon remains in the soil. In one group of species having this habit the first true leaf appears soon after germination. In another group (*L.*

superbum, *L. canadense*, and *L. Grayi*) the first leaf does not appear above ground until a year later; during the first year a fine little bulb develops in the soil within or just outside the seed coat. In growing such seedlings it is well to keep in mind

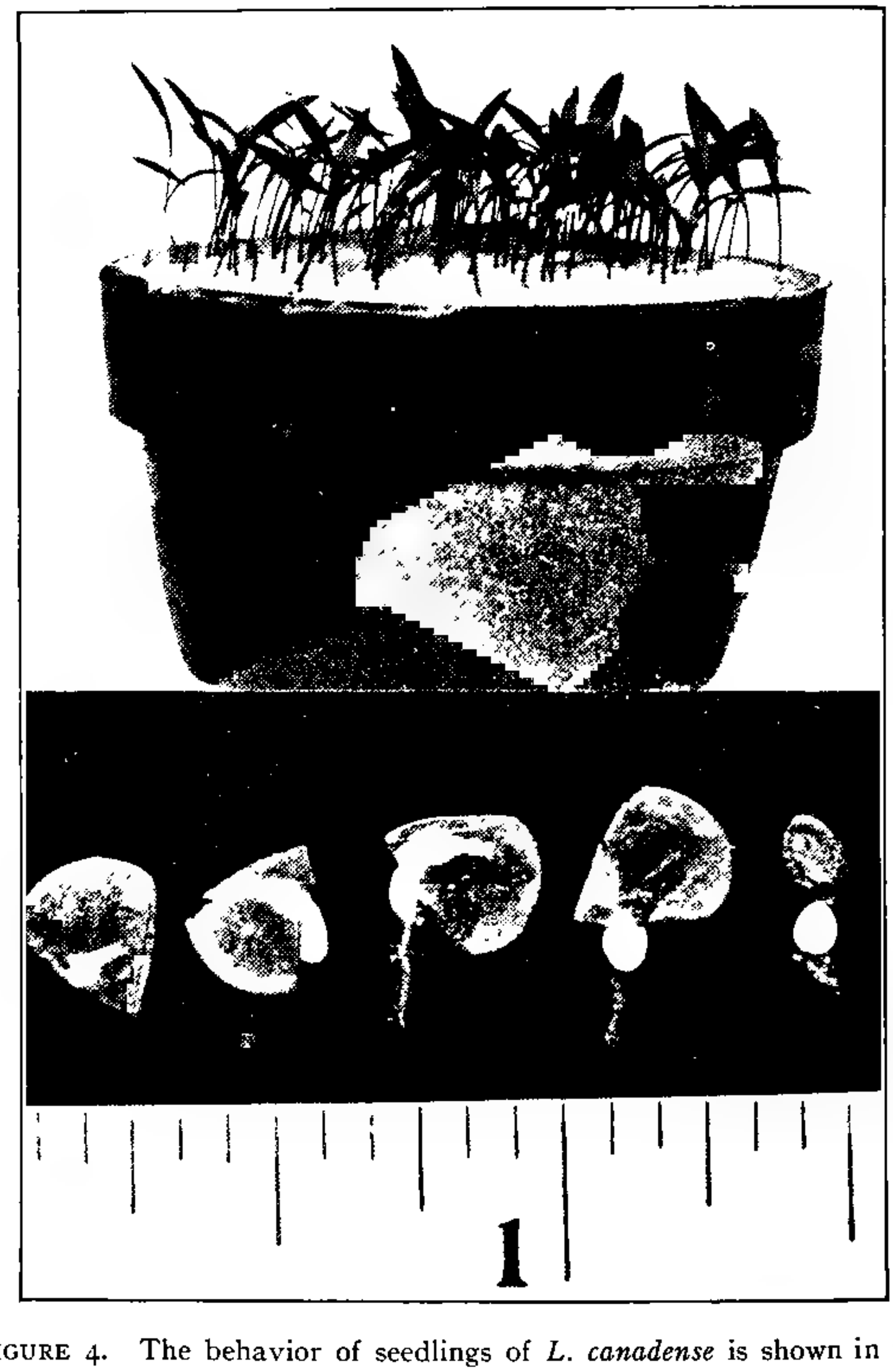

FIGURE 4. The behavior of seedlings of *L. canadense* is shown in these two views. During the first summer only a small bulb forms and nothing shows above ground, as indicated in lower view taken in September and enlarged nearly two times. In the following April these seedlings sent up the first leaf (see upper view) and are there about one year old.

this habit and to give proper care during the year that nothing shows above ground.

Care of seedlings. Two methods of treatment of seedlings in respect to the time of potting or pricking from seed pan may be employed. One may wait until the plants become dormant before potting and this seems to be a proper treatment for seedlings of autumn sowings of seed, or one may transplant from pans to small pots at or about the time when the first leaf is well developed, a plan that may generally be recommended for seedlings of spring-sown seeds. For rapidly growing seedlings like those of *longiflorum* a later repotting with proper care will keep plants growing rapidly so that blooms may be had in the following year. For several of the slower-growing lilies, single plants are placed in two inch or three inch pots, or several plants are placed in one pot of three, four, or five inch size, the pots are sunk to the level of the brim in a cold frame and left there during one summer of growth. When repotted in the following autumn, or if growth warrants, and it frequently does in the case of *regale*, *speciosum*, *Henryi*, and *croceum*, a planting directly to the garden may yield blooms in the following year. A considerable number of species, of which *speciosum*, *canadense*, and *auratum* may be mentioned, have been rather slow in growing and for these several years of nursing in pot culture or other special culture may be necessary before the seedlings reach a blooming size.

No attempts have been made in these experiments to grow seedlings in an outdoor seed bed. Perhaps with special attention to the preparation of such a bed, to the watering of the young plants during dry periods, and to protection by mulching during winter and with proper transplanting as needed, seedlings of such species as *Henryi*, *regale*, *speciosum*, and *croceum*, could be thus reared. They could certainly be grown in cold frames; a hot house is not essential to success. In the efforts to make exact studies of sterility, and of variation and heredity, it is desirable to grow plants to blooming age in pot culture, keeping the identity and pedigree of each. But this is not at all necessary in general garden propagation. After a year or two of culture in pans, flats, and pots, the bulbs may be placed in the garden.

Species of which seedlings are being grown. Successful germination has been obtained with the seed of the following named

species but in some cases, as indicated, the seed of certain species was obtained only by inter-specific cross-pollination:—*auratum*, *auratum* × *speciosum*, *Batemanniae* × *dauricum*, *canadense*, *canadense* × *Grayi*, *canadense* × *superbum*, *candidum*, *croceum*, *croceum* × *dauricum*, *croceum* × *elegans*, *dauricum* (*umbellatum*) × *elegans*, *dauricum* × *croceum*, *elegans*, *elegans* × *croceum*, *elegans* × *dauricum*, *Grayi* × *canadense*, *Henryi*, *Humboldtii*, *Humboldtii* × *Parryi*, *Kelloggii*, *Kelloggii* × *Parryi*, *Kelloggii* × *Roezlii*, *longiflorum*, *Martagon*, *monadelphum*, *Parryi*, *parvum*, *philadelphicum*, *philippinense*, *regale*, *Roezlii* × *columbianum*, *Roezlii* × *Parryi*, *Sargentiae*, *Sargentiae* × *regale*, *speciosum*, *speciosum* × *auratum*, *sulphureum*, *superbum* × *canadense*, *sutchuenense*, *tenuifolium*, *tigrinum* × *Maximowiczii*, *tigrinum* × *sutchuenense*, *warleyense*, *warleyense* × *pseudotigrinum*, *warleyense* × *tigrinum*, and *washingtonianum*.

FIGURE 5. From left to right: seedlings of *Lilium longiflorum*, *L. croceum*, *L. Henryi*, and *L. speciosum*. Showing plants in May from seed sown in the previous September. The growth made during the autumn and winter has given these seedlings a decided start ahead of seedlings from spring sowing of seed.

Seedlings have now been brought to blooming age of *speciosum*, *longiflorum*, *Henryi*, and *croceum* × *elegans*. Those of several other species give promise of blooming at the age of two or three years. For some species and for several of the crosses the seedlings have made feeble growth only, and for these it is not at all certain that plants will be reared to the blooming stage.

Cross-fertilization is evidently desirable in breeding lilies. Although seed may frequently be had from certain plants of many species of lilies to controlled self-pollination, the general results seem to indicate that more seed per capsule will mature on the same plant if there is compatible cross-pollinations within the species and that the seedlings from such crossings will usually

FIGURE 6. Seedlings of *Lilium tenuifolium* at only twenty days after seed was sown in September. Several leaves soon followed the cotyledon here shown for each seedling. The plants became dormant in mid-winter, when they were placed in pots ready for rapid growth during the following summer.

be the more vigorous. There are apparently many grades of both self- and cross-compatibilities in fertilization that influence not only the number of seeds produced but the vigor of the resulting offspring. Most species of lilies that freely set seed in garden culture are a mixture of several strains which are being crossed among themselves in the course of open insect pollination. Much of the seed one gathers from garden plants is undoubtedly from cross-pollination within the species. The very decided

self-sterility of many individual plants makes cross-pollination necessary if any seed whatever is to be produced by them.

It should perhaps be here stated that some question has been raised by certain earlier breeders of lilies as to the exact rôle or effect of cross-pollination between different species. It has been reported that even when the stamens are properly removed and other precautions taken to insure only cross-pollination between species of lilies that true hybrids are rare and that most of the seedlings thus obtained have been like the mother plant. Such a result would, of course, limit the possibility of securing hybrids from cross-bred seed. This matter is one of special interest and the offspring of cross-pollinations between species, of which a considerable number of combinations are now being grown, will be carefully studied for evidence bearing on this point.

The large number of seedlings now being grown will be utilized fully in continuing the various studies of which the above report covers only one aspect. They will ultimately be used to increase the plantings for public display in the Garden.

A. B. STOUT.

A BOTANICAL EXPEDITION TO EXTREME WESTERN CUBA

The western portion of Cuba, hitherto botanically unknown, has recently been studied by Dr. Juan T. Roig of Pinar del Rio, who, accompanied by Mr. Stephen C. Bruner, entomologist, traversed it, for the most part on foot, April 5–14, 1924. Cape Corrientes and the region of Corrientes Bay on the southern coast had been reached by sea by Dr. C. F. Millspaugh in 1899, and also by N. L. Britton and John F. Cowell in 1911,[1] but nothing was known botanically of Cuba further west. The region is sparsely inhabited west of Puerta de El Gato and little cultivated, there being very little arable soil; dog-tooth limestone rocks extend over most of it, with extensive mangrove swamps along the northern coast. The limestone supports a forest of low trees, with little herbaceous vegetation. Charcoal burning is the only industry. There was formerly a road through the middle of the peninsula, now abandoned. Reaching La Majagua,

[1] Jour. N. Y. Bot. Gard. **12**: 93. 1911.

on the southern coast a few miles west of Corrientes Bay on the third day out, Messrs. Roig and Bruner turned northward and crossed the rocky peninsula to Carabela Grande near the northern coast, and then followed a bad road near that coast westward for some miles, turning southwest, across the peninsula again, to Bolondron, and Santa Cruz, and thence westward to the lighthouse on Cape San Antonio and northeasterly to Morros de Piedras, whence return was made by sea to civilization at La Fé, and by road to the point of departure, El Cayuco.

This interesting, but very difficult trip was aided by a grant from the Exploration Fund of The New York Botanical Garden, and Dr. Roig has sent a complete set of the plants collected for our herbarium and also a map showing the route. This collection, while not large, is valuable as illustrating the geographic distribution of Cuban plants, and it includes specimens of several species new to science and apparently restricted to this peninsula.

The total distance travelled from El Cayuco to Morros de Piedras is about 120 kilometers, say about 70 miles; Messrs. Roig and Bruner thus covered an average of about 7 miles a day for ten days consecutively. When we consider the energy and exertion required for such work nearly at sea-level in the roughest kind of a country in Cuba, and the only possible reward the addition that may be made to scientific knowledge, we must extend our compliments to the explorers. But Dr. Roig regards the trip as a reconnaissance; it enabled him to ascertain that the country within about ten miles of Cape San Antonio is the most promising for subsequent botanical study and that there are some red-soil districts in that vicinity which may prove to be cultivatable. He therefore proposes soon to return by sea, establish a base at the Cape, and study this region intensively. Several of the trees observed were barren at the time of his first visit and thus not determinable accurately.

N. L. Britton.

THE IRIS GARDEN, 1924

(WITH PLATE 294)

The present Iris season, while a week or two late, was a lasting one. Favorable weather at blooming time helped, and conditions in general made for a free-flowering Iris garden. The features of the Iris Test Garden this year were the blooming of some of the Mrs. Dean's California varieties, the excellent showing of the new varieties of the Amos Perry Collection, originated in England, and some of the Mohr hybrids, containing blood of *Iris mesopotamica* and others.

Among the better varieties which bloomed for the first time were Ambassadeur (Vilmorin), Suzanne Antissier (Denis), and Mlle. Schwarz (Denis).

Through the interest of Mr. J. C. Wister, President of The American Iris Society, a considerable number of the Irises not yet in the test garden have come in. Plans perfected for the coming year include the planting of an entire set, probably numbering over one thousand varieties, in alphabetical arrangement, on the hill opposite Fordham Hospital. This scheme will make it easier for students and growers to find and study varieties. Mrs. Lucius Hitchcock and Mrs. W. H. Peckham, of New Rochelle have completed the study of the dwarf varieties, and have perfected plans for gathering these together and displaying them in color masses along the rock ridge in the Iris Garden.

KENNETH R. BOYNTON.

SUMMER WORK WITH IRISES

The collection of Japanese Irises, planted at the foot of the Iris garden slope, entrance on Southern Boulevard, in elegant bloom during the first two weeks of July, contains over 60 named kinds; the plants were given by Mr. B. H. Farr and by Mr. J. C. Wister.

It is planned greatly to enlarge this plantation, which was experimental; the plants have grown here exceedingly well, however, showing that the situation suits them; many of the clumps may now be subdivided and the plants distributed over a much greater area, and many more plants have been prom-

ised for setting out this year through the interest of Mrs. Wheeler H. Peckham, of the Garden Advisory Council, expert in Iris.

The main Iris collection formed in coöperation with The American Iris Society, wonderfully attractive in June, now past blooming, is being rearranged into four series of specimens. (1) An arrangement alphabetically by the names of over 1000 varieties, including many not hitherto represented in the collection, in new plots on the slope south of the present plantation. (2) The dwarf kinds will be brought together in three plots. (3) The main collection will be ultimately rearranged by color, for better floral effect, with some restriction of the area planted. (4) The wild North American species will be grouped by themselves.

Dr. John K. Small, Head Curator, is making an important investigation, in coöperation with Mr. Charles Deering, of the native Irises of the Southern States and during several trips to Florida, Georgia and the Carolinas has brought many plants to the Garden which flowered this spring in nursery pits and fine paintings of the several kinds were made by Miss Mary E. Eaton for illustration in "Addisonia;" his studies and these paintings show that there are more species in that region than have been hitherto known, some of these as yet undescribed; he is now again in Florida for the purpose of obtaining the seed-pods of the various kinds so that they may be illustrated with the flowers; while these southern kinds flowered freely in the nursery pits they did not set fruit. The next experiment with them will be to plant all the kinds in an unprotected nursery plot in order to ascertain if any of them will prove hardy at New York; many are very beautiful.

N. L. Britton.

THE CACTI[1]—AN INTERESTING PLANT-GROUP IN THE STUDY OF SURVIVAL

Cacti, a short and convenient Latin word used popularly to designate the plants belonging to the natural family Cactaceae, are without equal in the vegetable kingdom in the matter of their varied and strange succulent forms of growth, their beauti-

[1] Abstract of a lecture given in the Central Display House, Conservatory Range 2, on Saturday afternoon, March 8, 1924.

ful, wax-like flowers—often wholly out of proportion to the rest of the plant—their fruits, so unusual in color and form, and also often in their armament.

These characteristic structures of cactus plants, whether gross or fine, indicate a long and mighty struggle of the family to maintain itself against extinction. As a group and individually the plants have fortified themselves to resist adverse environments, have made trebly sure the propagation of their kinds. For example, the stems—varying from cord-like to columnar, barrel-like, tub-like, bowl-shaped, or pad-like—are armed to a remarkable extent for self-protection or for distribution, are abundantly stored with water and nourishment, and are thus not only adapted for resisting desert conditions, under which most of them now grow, but also for vegetative propagation. The roots, too, are succulent, often growing to great lengths in their search for moisture and nourishment in a poor or dry soil, or again, in many species, for some reason becoming short and thick, even globular. When these tuber-like structures are detached from the parent plant they give rise to a new plant, thus making a second kind of vegetative propagation.

The flowers, usually conspicuous, often very showy, are likewise especially adapted to insure propagation, in this instance by seeds. The showy perianth, either diurnal or nocturnal, white or of all shades of colors, except blue, is attractive to insects. Within are numerous, often almost myriad, stamens, whose anthers await the insect visitors with pollen ever ready to be transferred to the stigmas.

Just as the flowers of cacti are attractive to insects, the resulting fruits, as a rule copiously seeded, are attractive to larger animals. Many birds especially, including migratory kinds, are ravenously fond of such provender and thus assist in the wide dispersal of the cactus seeds.

Cacti are confined naturally to America. The occurrence of a few species of a certain genus (Rhipsalis) in Africa is attributed to the activities of migratory birds, and this within comparatively recent times. These particular plants are mistletoe-like both in habit and in the small pellucid glutinous fruits. A parallel example of mistletoe distribution has recently come to light in southern Florida. The fruits of the native mistletoe are likewise glutinous and are carried by birds from one tree to another.

The birds usually alight near the tips of branches of trees, and there the mistletoe-like cactus (Rhipsalis)—sometimes called pencil-cactus, on account of the slender pencil-like joints of the stem—grows on the oak trees in tropical Florida, planted there doubtless by migratory birds coming up from the West Indies where the pencil-cactus in question, *Rhipsalis Cassutha*, is so plentiful in the forests.

Man also has had an important part in cactus history. Several kinds of flat-jointed cacti (Opuntiae) were taken back to the Old World by the early expeditioners shortly after the discovery of the New World by Christopher Columbus and became naturalized in the Mediterranean region. Here they have since maintained a foothold. Again, towards the end of the last century, other kinds, presumably from Mexico and South America, were carried to Australia. But here, carelessly thrown away by settlers, these plant-strangers not only promptly became naturalized but overran the land like wild-fire, spreading both by vegetative parts and by seeds, thus furnishing a conspicuous example of how well the group had perfected its methods of propagation. They have already taken possession of millions of acres. The end is not in sight. To date, having defied all methods of extermination, they are spreading into new fields, entailing great financial losses.

On the other hand, cactus plants have an ancient and honorable, even a beloved, place in human economics. Fresh and cured cactus-fruits have formed a very important, in fact almost indispensable, food in the life of aboriginal man in America since times remote. Take, for example, that instructive quotation from brave Alvar Nuñez Cabeza de Vaca, written in the early part of the sixteenth century:

"After which time they would remove to another section in order to eat prickly-pears. These are a fruit of the size of an egg, red and black, and taste very good. For three months they subsist upon them exclusively, eating nothing else," and again:

"Their best times are when tunas [prickly-pears] are ripe, because they have plenty to eat, and spend the time in dancing and eating day and night. As long as these tunas last they squeeze and open them and set them to dry."

It is a description that would almost fit certain tribes and

seasons in America today—especially in the desert reaches of our own Southwest and Mexico.

Nor was only the fruit itself important. Among various primitive folk the seeds were—and still are—ground up for flour, and as for the succulent stems, some of these still serve as a valued vegetable in the aboriginal cuisine. The cactus confection is well known, also the value of cactus as a forage plant for animals wild and tame when other pasturage is lacking.

And need we mention that the juice of some of the fruits of cacti is made into a primitive alcoholic drink? Other kinds furnish primitive man with a drug and a narcotic. This is notably the case in the so-called "mescal button"—not to be confused with the mescal magueys of Mexico. The mescal button, or peyote (*Lophophora*), has many an unhappy page devoted to it in the annals of the Indian Bureau. Among some tribes it is even the basis of a religious cult.

But to revert to the structural and physiological points of interest possessed by this plant family, we may add that among these should be mentioned the singular mechanics of the cactus stem—a mechanism to insure the longer life of the individual. For example, the "joints" of the opuntioid kinds, that is, those plants with flattened internodes—"pads," as they are often called,—are often placed successively criss-cross so that only about half the surfaces of the plant is exposed to the wind whichever way it may blow. In the case of the columnar or cereoid types with their mass of soft watery tissues, we do not find the stem round and even, but strongly, often copiously ribbed. The ribs, of course, give the axis added strength.

Physiologically considered, two closely associated conditions stand out prominently. One of the most striking characteristics of cacti is the absence of leaves in the vast majority of the kinds. As deserts became the typical homes of cacti, leaves would be a distinct detriment to the plant, under the normal conditions existing there, for the moisture would be given off from the plant more rapidly than the roots could supply it from the scant reserve in the soil. So, leaves were long ago dispensed with, and the transpiration area reduced to the surface of the stem, which in all respects now functions as a leaf. In addition, the transpiration of moisture is also partly regulated—reduced or accelerated—from within the stem. The sap or cell-content

is largely mucilaginous, and latex, or milk, is also sometimes present. The conditions of this gummy cell-sap, regulated according to external conditions, when thicker checks transpiration and when thinner accelerates it accordingly. In addition, in case a plant is wounded, this mucilage promptly spreads a coating over the exposed tissues, and then forms a callus by which serious infection is prevented from gaining access to the internal tissues of the plant.

Although cacti are most abundantly developed, both in size and numbers, in and near the American tropics, they are not—as we have already indicated—confined to those regions. In the north-temperate zone the geographic ranges of a few kinds of prickly-pears (*Opuntia*) extend up into southern Canada, while in the south-temperate zone many kinds of cacti are found in Chile and Argentina.

All told, there are more than twelve hundred kinds of cacti which are embraced in one hundred and twenty-five genera.

The great cactus centers are in our Southwest, and in Mexico, parts of South America, and the West Indies, New York lies in one of the minor cactus areas—the eastern Coastal Plain, extending from Massachusetts to Florida. The real extent of this cactus field was not realized until lately.

JOHN K. SMALL.

THE BRONX RIVER PARKWAY[1]

"The Bronx River . . . all willows and lush grasses with big dock weeds flaunting their green flags, thousands of buttercups and daisies, . . . It's as full of birds and butterflies as England along the Thames or one of those ducky little streams out of Paris."

This was F. Hopkinson Smith's description of the Bronx River 25 or more years ago.

In the first of the summer series of the Garden lectures of 1924, Mr. Downer used 100 lantern slides showing the contrast between former and present conditions along the Bronx River valley, which has been completely transformed by the Bronx River Parkway, now nearing completion.

[1] Abstract of an illustrated lecture given in the Museum of The New York Botanical Garden on the afternoon of June 1, 1924.

In the Williamsbridge section, so delightfully described by Smith in "A Day at Laguerres" and other sketches, shacks, stables, and barn yards had despoliated the natural beauties of the river's banks.

With the growth of population northward from Bronx Park toward Mount Vernon and the development of White Plains and other Westchester towns, the Bronx River suffered the usual fate of small streams, the wet marginal lands of which became general dumping grounds. Sewage discharged into the river at the upper valley towns fouled the stream in the Williamsbridge section and flowed into the Botanical Garden lakes. The conditions became so bad that the Bronx River Parkway improvement was undertaken and active work commenced in 1913.

The Parkway includes strips of land on both sides of the river from the Botanical Garden to Kensico Dam at Valhalla, a distance of 15 miles. Old buildings, dumps, and nuisances have been removed, sewage pollution eliminated, swamps drained and filled, and a 40-foot motor driveway is completed throughout the greater portion of the distance. This driveway now provides a northern outlet from New York City for thousands of automobiles, and will be practically completed to Kensico Dam this year.

Lantern slides illustrating Westchester County's new park system were also shown. During the past year the County Supervisors have authorized appropriations for a park program involving an expenditure of $7,000,000 for lands alone. Under this program water-front parks have been acquired at Croton Point, Kingsland Point, and Crugers, on the Husdon River, and at Manursing Island near Rye Beach and Glen Islands in the Sound.

Interior parks have been acquired in the Tibbetts Brook valley in Yonkers just north of Van Cortlandt Park and continuing as a parkway along the Saw Mill River valley to Chappaqua.

A parkway has also been laid out along the Hutchinson River in Mount Vernon, and a park at Silver Lake at the head of the Mamaroneck River in White Plains. In this new system an extension of the Bronx River Parkway will be made from Kensico Dam through Briarcliff to Croton Lake, from which it will pass through Westchester County's 1100-acre park at Mohansic

Lake and continue to the new bridge spanning the Hudson rom Anthony's Nose to Bear Mountain. This parkway extension, including the Bronx River Parkway, will make a complete circuit through Westchester County to connect with the Palisades nterstate Park at Bear Mountain. The length of this circuit, which will be continuous from the plaza at 59th Street and Central Park, will be 125 miles.

JAY DOWNER,
Engineer and Secretary of the Bronx Parkway Commission.

THE SNAPDRAGON RUST

Attention has recently been called to the destructive work of the snapdragon rust known scientifically as *Puccinia Antirrhini* Diet. & Holw. A New York correspondent, Mr. H. A. Gibbs, writes as follows: "The disease appeared first five years ago on plants outside in the garden. The following year seedlings were grown in the greenhouse and were immune. Next year I did not grow any of this kind of plant at all, but in 1922 we lost fully 1000 plants which had arrived at about the height of this sent herewith. In 1923 we got about 85% of the plants free from disease, but these were removed from the greenhouse and put into cold frames and after that very little rust appeared."

This fungus was originally described from material collected n California, the description being published by a German in a European botanical journal, in 1895. The Californian specinens were collected by W. C. Blasdale, who in a note published n 1903 states that the fungus has appeared there every year since and in every case destroyed the plants shortly before they had reached the flowering stage.

In 1913 the fungus was reported as responsible for a great deal of damage to the cultivated snapdragon in the vicinity of Chicago. The disease continued to spread rapidly until it is now found wherever the host is grown in the greenhouse.

Beautifully rusted specimens have been received from the correspondent quoted above and since the matter may be of nterest to others it is thought well to publish this brief note. While the fungus is well known and widely distributed in this

country the control methods have not been very satisfactorily worked out. We will publish a summary of the work done along this line in Illinois.

Control

The control methods recommended by Mr. George L. Peltier of the Illinois Experiment Station, where a great deal of damage has been done and many experiments conducted, are as follows:

"Snapdragon rust may be partially controlled in the greenhouse by giving attention to cultural methods. Growing the plants under the best conditions in a clean, well-kept, and well-ventilated house will check to some extent the dissemination of the disease. Plants should not be syringed if this can possibly be avoided but instead the soil only should receive water when the plants require it.

"In order to eliminate the rust, it is recommended that all infected material be destroyed, the house cleaned, and after a year or two new stock secured which is free from rust. The latter may be secured by the use of seed and the practice of selection."

FRED J. SEAVER.

PLANTS USED BY ANCIENT AMERICAN INDIANS

Dr. M. R. Gilmore of the Museum of the American Indian has recently made two visits to the Museum of The New York Botanical Garden. On his first visit he brought with him for determination pieces of wood, fibers, fruits, and seeds, found in the caves of the bluff-dwellers of the Ozark Mountains of Arkansas and Missouri, and also a few plants used by the present Indians of the Dakotas. On his second visit he brought mostly seeds used by the Indians of Arizona and New Mexico. The bluff-dwellers lived at least 1,000 years ago and not only preceded the present Indians but also another race of aborigines which intervened. They lived in the Stone Age and so did the intermediate race, but apparently before bows and arrows were invented. They used darts, the heads of which were made of flint and other stones; the piece of the shaft nearest the head was made of branches of birch and other trees; the tail

end, of stems of the Reed, really a woody grass and the only representative of the bamboo tribe in the Southern States. In fact, the only piece of wood that I was able to determine with any certainty was a piece of this Reed. Dr. Small, who was in Florida at the time, may be able to name more of the pieces of wood.

One of the fibers used was from the Indian Hemp, *Apocynum*, and another looked like the bast of a grape vine. The bluff-dwellers cultivated corn, squashes, sun-flowers and beans, similar to those the later Indians used to raise. They evidently used also other seeds for food, for such have been found among their stores; for instance, a species of Pigweed, *Amaranthus*, probably *A. retroflexus*, a Lamb's-quarters, *Chenopodium*, probably *C. Boscianum* or *C. Berlandieri*, and *Phalaris caroliniana*, a grass related to the canary-bird seed. Among the stores, there were also, curiously, seeds of the Great Ragweed, *Ambrosia trifida*. As the seeds of all species of *Ambrosia* are exceedingly bitter, it is not probable that they were used for food, but for medicine or for incense in religious ceremonies. By the way, the Ambrosia of today could hardly be the same as the Ambrosia, the "food of the gods" of the old Roman and Greek mythology or else the tastes of gods and men must be quite different, unless we have changed in the last few thousand years!

Among the Dakota plants brought in, is a species of Orach, *Atriplex argentea*. In many places, the Indians before they had begun trading with the white man or with their hostile neighbors, could not get salt. There is in reality no lack of salts in the alkali flats of the Dakotas, but the common or cooking salt is so mixed with other salts that it is useless. This Atriplex, which is often called Saltbush, and grows on the alkali plains, was used as a substitute to give the salty flavor.

P. A. RYDBERG.

CONFERENCE NOTES FOR MAY

A conference of the Scientific Staff and Registered Students of the Garden was held on the afternoon of May 7th.

Doctor W. A. Murrill spoke of "the outstanding features" of his recent trip to South America. This was a general account

of the journey with a display of specimens, numerous curios, and articles made of various woods. A report of the scientific work accomplished will be given by Doctor Murrill at another time.

The second item of the program was a talk by Dr. Ralph R. Stewart on "Ornamental Plants of the Punjab," an abstract of which follows:

The Punjab is a large province in the northwest of British India, extending from Delhi on the south to the Indus River on the north. The majority of the twenty or more millions of inhabitants live in small villages and do not pay any attention to decorating their persons or homes. No matter how small the village, there are no grass plots or gardens around the home but the adobe houses are close together and are built enclosing a courtyard where the animals are stabled and a good deal of the work of the home is done. The trees found in an ordinary village are not numerous. One is likely to find the mulberry, the jujube (*Ziziphus Jujuba*), the shisham (*Dalbergia Sissoo*); *Albizzia Lebbek*, *Ficus religiosa*, *Ficus bengalensis*, *Melia Azedarach*, the Persian lilac or umbrella tree, and probably a few wild dates (*Phoenix sylvestris*).

In the larger towns, where there may be a few men of wealth, fruit and flower gardens are found. The plants raised are much like those to be found in similar situations throughout the world. The common fruit trees are the loose-skinned orange or narangi, guavas, mangoes, loquats (*Eriobotrya*), the plum, the apricot, and the banana. Favorite ornamental shrubs are the rose, jasmines, various species of Hibiscus, *Lawsonia alba*, and *Nerium odorum*.

In the cities where there is more or less foreign influence, there are many ornamental plants. Even in the business part of town the stores and office buildings have gardens. A large number of exotics have been introduced but the commonest trees are the Crepe Myrtle, Bauhinia, Dalbergia sp., Albizzia sp., Thevetia, the Pepper tree, Eucalyptus sp., *Grevillea robusta*, *Bombax malabaricum*, various acacias, *Cassia fistula*, Cordia sp., Terminalia sp. and toward the foot hills of the Himalayas, *Pinus longifolia*.

The natives ordinarily use flowers for but two purposes, garlands and in temple worship. In welcoming guests and in bidding

them farewell, garlands of marigolds, orange blossoms, or jasmine are great favorites. At times roses may be used for the same purpose. In temple worship the marigold is the favorite flower. The idols and phallic emblems may be garlanded or the flowers are thrown in the shrine as an offering. In Kashmir the lotus is much used in worship. The tulsi plant, *Ocimum sanctum*, is an object of reverence by Hindus and a pot of this may be found in almost every Hindu home. In addition the pipul (*Ficus religiosa*) is a sacred tree and Hindu holy men frequently make a rude shelter in its shade and village shrines are commonly built beside it.

The British Government has taken pains in planting roadside trees widely in the Punjab and from a slight elevation the course of the roads may be followed for miles by the lines of trees. *Dalbergia Sissoo* and *Albizzia Lebbek* are probably the commonest roadside trees, though in the more arid regions two acacias, *Acacia arabica* and *A. modesta*, are very common. In Kashmir, which used to be the summer resort of the Mogul emperors, the roads are bordered by Lombardy poplars. One famous road has over thirty miles of this tree. The Oriental plane tree, *Platanus orientalis*, grows to a great size in Kashmir and is a favorite shade tree.

The Mogul emperors were great gardeners and many of their gardens are still kept in good repair. Their gardens are all formal, rectangular in shape and are usually terraced. In the center of the garden there is usually a tank of running water with fountains which play on special occasions. A pleasure house is usually placed beside or in the middle of the artificial pool.

Fences are not common in the Punjab but hedges are used a great deal. For this purpose various species of cactus, *Euphorbia Royleana*, the century plant, and *Acacia Farnesiana* are common. Europeans have come to use *Dodonaea viscosa*, a privet-like plant, Duranta, the lime, and the century plant for their hedges.

Out through the country districts the trees are often disfigured through lopping in times of drought and famine. The goats and cattle are brought up to eat almost anything. Even in the mountains where the pasturage does not seem to be poor, the shepherds lop branches from the trees, especially from maples and horse chestnuts and the cattle seem to enjoy eating the fresh leaves.

PUBLIC LECTURES DURING AUGUST

Free illustrated public lectures will be delivered in the lecture hall of the Museum Building at four o'clock on Saturday and Sunday afternoons during August, as follows:

August 2. "Floral and Scenic Features of Porto Rico"
Dr. M. A. Howe.

August 3. "Flowers for the Home Garden"
Mrs. W. H. Peckham.

August 9. "Plant Quarantine Work at the Port of New York"
Mr. H. B. Shaw.

August 10. "The Royal Botanical Garden at Kew."
Dr. W. A. Murrill.

August 16. "Botanizing in Trinidad" Dr. F. J. Seaver.

August 17. "The Yellows Disease of Asters and Other Plants"
Dr. L. O. Kunkel.

August 23. "Florida, the Paradise and the Paradox"
Dr. J. H. Barnhart.

August 24. "The Nitrogen Problem and the Farmer"
Mr. J. G. Curtis.

August 30. "The Hudson River Valley before the Advent of Man" Dr. Arthur Hollick.

August 31. "The Paris Botanical Garden" Dr. W. A. Murrill.

NOTES, NEWS, AND COMMENT

Dr. A. B. Stout spent the last week of June at the State Experiment Station at Geneva in continuing studies of the sterilities of fruit crops and in further work in the breeding of grapes for the development of new and hardy seedless varieties.

Dr. Arthur Hollick, Paleobotanist of the Garden staff, has returned from Washington, D. C., after a five months' leave of absence for the continuation of his work on the fossil flora of Alaska in connection with the U. S. Geological Survey. The results of Doctor Hollick's work will appear in the form of two quarto volumes, as Memoirs of the Survey, one on the Cretaceous and the other on the Tertiary flora. The Cretaceous volume has been completed and transmitted for publication.

Miss Martha Warren Beckwith of The Folk Lore Foundation of Vassar College, who is engaged in an interesting investigation

of the uses of plants made by the negroes in the island of Jamaica, spent a day at the Garden recently with Dr. Britton, identifying a collection of Jamaica plants made by her, associating the native names of these plants with their botanical names.

Among the visitors who registered in the library during the spring were the following botanists: Profs. M. A. Chrysler and C. H. Connors, New Brunswick, N. J., Prof. L. H. Bailey, Ithaca, N. Y., Dr. Charles Thom, Washington, D. C., Mr. C. J. Humphrey, Madison, Wis., Dr. J. H. Faull, Toronto, Can., Dr. L. H. Knoche, San José, Cal., Mr. J. Christian Bay, Chicago, Ill., Señor Ernesto de Murillo, Bogota, Colombia, Prof. Jean Massart, Brussels, Belgium, and Dr. Albert W. C. T. Herre, Manila, P. I.

The frequent rains in May and June followed by warm weather toward the end of June brought out an unusually large crop of fleshy fungi on lawns and cultivated ground. *Naucoria semiorbicularis* was never more abundant. A specimen of *Stropharia melanosperma* was picked by Dr. Murrill in front of the Museum Building on June 28 and the first plants of *Agaricus campester* were noticed the following day. In the woods, a yellow species of *Russula* was fairly common. Three weeks previous, he had collected *Cortinellus ruinlans* at Hartsdale; but on June 29 in the Hemlock Grove were found the largest specimens ever seen here of this beautiful mushroom, which measured 15 cm. across and had a stipe 10 cm. in length and 2.5 to 3 cm. thick. Some distance away, it suggested *Melanoleuca Russula.*

Mr. Herbert Muirhead, C.E., gave a lecture on "Scottish Wild Flowers" at the Garden on May 18, 1924. His lantern slides were photographs in natural color made by Harry E. Duncan of Glasgow, and included many rarely beautiful scenes in Scotland.

Mr. LeRoy Jeffers, F.R.G.S., the Secretary of the Associated Mountaineering Clubs of North America, which numbers about 60 organizations, lectured at the Garden on the afternoon of May 11 on his "Rambles among the Mountains." A wide variety of mountain scenery was shown, ranging from the Adirondacks and Mt. Ktaadn in Maine, westward through the colorful desert scenery of the southwest to California. An urgent plea

was made for the inclusion of the Kings River region and Tehipite Valley in the proposed enlargement of the Sequoia National Park. It was pointed out that it is more important for the nation to preserve this supremely fine scenic region for its aesthetic and spiritual value than to ruin it by allowing commercial inroads for the benefit of a few. A number of our northwestern mountains gave opportunity for thrilling scenes of rock-climbing and of snow and ice work. Many western wild flower views of remarkable beauty were also shown.

Dr. W. C. Sturgis has presented his herbarium of fungi to The New York Botanical Garden, reserving the Myxomycetes for further study. The 2135 specimens of fungi (and 64 of algae) have been collected over a wide range, mostly by Dr. Sturgis himself. Massachusetts, Colorado, and Florida appear very often on the labels, while few of the states are omitted entirely. It is a delight to find the collections so well classified and so free from insect ravages.

In the lecture on "Wild Birds of New York City," which was delivered at the Garden on the afternoon of June 8, by Mr. S. H. Chubb, there were shown most unexpected possibilities of bird-study, even for those who must dwell in a great city. The lecturer has for many years been connected with the American Museum of Natural History. His keen observation of nature during long experience as a field naturalist, his success as a photographer of wild life in its native haunts, and his excellent collection of colored slides enabled him to bring picturesque and graphic scenes of bird-life before the minds of his hearers. When one sees how the lecturer has scaled the walls of city apartment houses to study the family-life of wild hawks and waded waist deep in spaces along Broadway, temporarily flooded, to make studies and photographs of the wild American egrets, he asks, "Why wander far afield to study Nature?"

Meteorology for June. The total precipitation for the month was 2.90 inches. The maximum temperatures for each week were 82° on the 7th, 84° on the 15th, 88° on the 22nd, and *93° on the 25th.* The minimum temperatures were *44½° on the 1st,* 48° on the 10th, 57° on the 17th.

ACCESSIONS

MUSEUM AND HERBARIUM

15 specimens of flowering plants from Panama. (Given by Mr. C. D. Mell.)

6 specimens of *Botrychium* from Vermont. (Given by Dr. Herbert M. Denslow.)

17 specimens of flowering plants from North America. (By exchange with the United States National Museum.)

27 specimens of mosses from Isle Royal, Michigan. (By exchange with Dr. George E. Nichols.)

2 specimens of hepatics from Alaska. (By exchange with Mr. W. C. Henderson.)

2 museum specimens of *Centrolobium* from Venezuela. (Given by Mr. C. D. Mell.)

179 specimens of flowering plants from Missouri. (Collected by Mr. B. F. Bush.)

613 specimens of flowering plants and ferns from the local flora range. (Collected by Mr. Percy Wilson.)

2 specimens of flowering plants from North Carolina and Florida. (Given by Mr. A. D. Huger.)

450 specimens of ferns and flowering plants from the local flora range. (Collected by Mr. A. T. Beals.)

10 specimens of marine algae from Atlantic City, New Jersey. (By exchange with the United States National Museum.)

26 specimens of marine algae from Miami Beach, Florida. (By exchange with Dr. William Randolph Taylor.)

108 specimens of flowering plants from the local flora range. (Collected by Dr. H. M. Denslow.)

1 specimen of *Riccia Gougetiana*. (Given by Miss Annie Lorenz.)

264 specimens of naturalized exotics from New York. (Given by Mrs. Mary Holzoff.)

4 specimens of Characeae from Louisiana. (Given by Dr. M. A. Barber.)

70 specimens of coral fungi, mainly from Chapel Hill, North Carolina. (By exchange with Professor W. C. Coker.)

15 specimens of fungi from Panama and Central America. (By exchange with the Smithsonian Institution.)

100 specimens "Fungi Exotici Exsiccati" fascicles 10 and 11. (Distributed by Mr. Hans Sydow.)

127 specimens of fungi from various localities. (By exchange with the United States Department of Agriculture.)

30 specimens of fungi from Kashmir, India. (By exchange with Mr. R. R. Stewart.)

1 specimen of *Ionomidotis chilensis*. (By exchange with Dr. Roland Thaxter.)

200 specimens "North American Uredinales." (Distributed by Mr. Elam Bartholomew.)

2 cotype specimens of fungi from North Carolina, *Mycosphaerella Oxydendri* and *Sphaerulina Oxydendri*. (By exchange with Dr. Frederick A. Wolf.)

215 specimens of fungi from South America. (Purchased from Rev. G. A. Bresadola.)

6 specimens of flowering plants from Staten Island, New York. (Given by Dr. Arthur Hollick.)

1 specimen of *Phormidium Corium* (?) from Lexington, Kentucky. (Given by Professor H. Gorman.)

7 specimens of flowering plants from New York. (Collected by Miss Margarette Lee.)

4 specimens of flowering plants from Long Island, New York. (Given by Mr. William C. Ferguson.)

5 specimens of marine algae from Rye Beach, New York. (Given by Mr. Prentiss M Howe.)

2 specimens of flowering plants from New York. (Given by Dr. J. K. Small.)

75 specimens of *Atriplex* and *Chrysothamnus* from North America. (By exchange with the Carnegie Institution.)

368 specimens of flowering plants from the Rocky Mountains. (By exchange with the University of Wyoming.)

48 specimens of flowering plants from Alaska. (By exchange with Mr. J. P. Anderson.)

82 specimens of flowering plants from Maine. (Collected by Mr. N. C. Fassett.)

500 specimens of flowering plants from Canada. (By exchange with Brother Marie-Victorin.)

17 specimens of marine algae from Uruguay. (Given by Dr. F. Felippone.)

103 specimens, "Kryptogamae Exsiccatae," Century 27. (By exchange with the Natural History Museum, Vienna, for the Columbia University herbarium.)

115 specimens of marine algae, mostly from New York and vicinity. (Given by the American Museum of Natural History.)

12 specimens of algae, mostly marine, from Long Island, New York. (Given by Mr. Roy Latham.)

7 specimens of algae from the Yellowstone National Park. (By exchange with United States National Museum.)

2 specimens of Characeae from Long Island, New York. (Given by Mr. Roy Latham.)

2 specimens of *Cryptozoon proliferum*, an Upper Cambrian fossil, from Greenfield, Saratoga Co., New York. (Given by the New York State Museum, Albany, New York.)

8 specimens of a lime secreting *Phormidium* from Inyo Co., California. (Given by Dr. W. T. Swingle.)

7 specimens of a fossil (Quaternary) algal travertine from the Salton Sea Basin, California. (Given by Dr. W. T. Swingle.)

68 specimens of mosses from Isle Royal, Michigan. (By exchange with Dr. George E. Nichols.)

37 specimens of mosses from Alaska. (By exchange with Mr. W. C. Henderson.)

25 specimens of flowering plants from Venezuela. (Given by Mr. C. D Mell.)

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THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

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Greenhouses, containing thousands of interesting plants from America and foreign countries.

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I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ————

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THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

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H. H. RUSBY

ETHYLENE, OR THE GAS THAT PUTS PLANTS AND ANIMALS TO SLEEP

WILLIAM CROCKER

THE ROSE GARDEN, 1924

KENNETH R. BOYNTON

ROSES AND THEIR CULTURE

MARSHALL A. HOWE

NESTING OF THE HUMMINGBIRD

R. S. WILLIAMS

THE FLOWER BEDS

KENNETH R. BOYNTON

NOTES, NEWS, AND COMMENT

ACCESSIONS

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JOURNAL
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TROPICAL AMERICAN PLANTS AT HOME—II. THE FUCHSIAS

My collections of native fuchsias have extended from central Mexico to central Chile. I have found none in a locality where frost was known, though sometimes beside ice-cold streams, fed by glaciers several thousand feet higher and almost over them. In all cases, the roots have been more or less shaded but, with the exception of a single species, the flowering branches were always exposed to sunshine. No fuchsia has been encountered growing in full forest shade, and very rarely have I seen them in soil at all subject to aridity. With few exceptions, they demand a soil perpetually moist, but with perfect drainage.

In texture, some of the smaller species are almost herbaceous, while others become small trees. While none are really climbing, many possess elongated branches which push through and partly recline upon other shrubbery, and the branches of nearly all droop more or less.

While no fixed lines of demarcation can be declared, we can recognize five general types of growth. One group consists of erect shrubs or small trees, with symmetrical crowns. Another comprises tall slender species, growing in thickets or shrub-borders, bearing much elongated and slender branches that droop over and depend from supporting shrubbery. A third group consists of prostrate species, their stems creeping and rooting amidst leaf-mold or other decaying vegetable matter. A fourth group includes low, widely-spreading half-shrubs, inhabiting rocky ledges. The fifth group consists of several very stout stubby shrubs, with scanty foliage, which inhabit arid or desert regions. Of this group, so very exceptional in

the genus, I am familiar with but one member, *Fuchsia rosea* R. & P., which inhabits the dry hills of western Chile. So unexpected is its habit of growth and appearance that no one encountering it without flowers, would be likely to recognize it as belonging to this beautiful genus. It is a low, scraggly, angularly branching shrub of rocky or sandy wastes. Its branches are short, thick and stubby, and some of the smaller ones are modified into thorn-like structures. At the ends of the short twigs some small crowded leaves are borne, but these are entirely absent in the dry season, when the shrub is sufficiently ugly-looking to be repulsive. When in flower, however, which in my experience is about the time at which the leaves appear, it is peculiarly beautiful. Its homely stumps of branches are then covered with foliage of a lovely soft green and its branches bear dense masses of small, pendent rose-colored flowers, after the manner of the bleeding-heart of our gardens, although the flowers are many times smaller. One or two other species, of similar habit and appearance, and native in the same region, are known to me only through herbarium specimens.

In strong contrast with these xerophytic species is *F. macrantha* Hooker, a species representing group number three of my classification. Like the last, it is but scantily provided with foliage, but for a contrary reason. It inhabits the darkest and densest of thickets, where its main body, a thick and softly woody stem, is buried and rooting in decayed vegetation, which is perpetually moist. These stems are often several yards in length. It appears like a saprophytic plant. At favorable points, it projects a short branch into the sunshine, or at least into the light, and at its end produces a few leaves and a small cluster, often only one or two, of very large and handsome flowers, which may be as much as three inches in length. The tube is narrowly infundibular, the limb short, abrupt and but little spreading. The color varies from a light orange-scarlet to a deep red. The species is widely distributed but nowhere abundant over a large area, at least from Ecuador to Bolivia, mostly between 6000 and 8000 feet altitude. Farther south it is replaced by a species of very similar habit, which I have provisionally referred to Hemsley's Mexican *F. salicifolia*, though it seems quite unlikely that the same species can inhabit these widely separated localities. The branchlets are much more leafy, the

leaves being large and long-acuminate, or almost attenuate, like some willows, from which it takes its name. The flowers, of a light orange-scarlet, are much more slender than those of the last, the very delicate sepals being long-acuminate, like the leaves.

Our second-mentioned group probably comprises more than half of the species of the genus and includes most of those attracting the attention of the passing traveller. These species are particularly characteristic of the northern countries of South America, and form a very conspicuous feature in the flora of Colombia. One of the most abundant is *Fuchsia venusta* HBK., which is also of interest as forming a sort of connecting link with the *macrantha* group. It is not very tall and ramifies extensively among the surrounding shrubbery. Its leaves are rather scanty and small, but its flowers are abundant at the ends of the branches. The latter are narrow in all parts and of a delicate cherry-red color. *Fuchsia magellanica* Lam. is a Patagonian species that is also somewhat intermediate between the two groups. It differs from the preceding in having very large slender flowers, the sepals being scarlet-red and the petals yellowish. Its pedicels are very long and slender, and its style and stamens are conspicuously exserted. One of the most beautiful members of this group was discovered by myself in the mountains about Huila, in southern Colombia, and which I have named *F. filipes*, in allusion to the long and filiform stems of the flowers. As one rides along the steep mountain-sides, the dense banks of foliage which flank the road are conspicuously spangled with the large, drooping clusters of these lovely flowers, of a peculiar shade of purplish-red. Not only are the individual flowers long-pendent, but the clusters themselves droop on elongated branchlets. The abundant oblanceolate leaves, about an inch in length, are thin and delicate, but of a very deep green. This species appears closely related to *F. coccinea* Ait. of Chile, distinguished for the extremely drooping character of its inflorescence. Its filiform pedicels are sometimes three inches in length, and the whole plant is remarkably slender. The flowers are of a bright scarlet-red and more than an inch in length. *F. gracilis* Lindley, of Mexico, also is of a slender and gracefully drooping habit. It has linear attenuate sepals and long-exserted style and stamens. It is peculiar for the diversity of its leaves,

very small ones being variously intermingled with much larger ones. A similar species collected by Dr. Pennell and myself near Balsillas, Colombia, with very dense terminal clusters of flowers having an orange tube and scarlet limb, on very short pedicels, is notable for the beauty of its foliage. These leaves are thick and nearly coriaceous, very deep green, very acute and sharply and beautifully serrate. It is almost certainly unnamed, but requires further study. *Fuchsia triphylla* L., of Ecuador, is another handsome member of this group. Its flowers are few but large, about two inches in length and nearly as broad and of peculiar form. The tube is narrow in its lower part and then suddenly dilated into a broad bulb-like summit. The flowers are of a deep crimson. *F. splendens* Zucc., of Mexico, appears very distinct from all the other members of the genus. Its abundant pale-green thin leaves are heart-shaped at the base, broadly ovate and acuminate. Its large, somewhat bell-shaped flowers are axillary, with rose-purple tube and yellow limb. The only species known to me that resembles it is *F. fulgens* DC., which has somewhat similar leaves, but the flowers, two and a half inches long, are slender, and nearly funnel-form. The calyx is yellow, the petals crimson.

It is probable that some of the species of the preceding group, if planted in the open, would assume the erect habit, but those of the group next to be described appear to be habitually erect growers, with spreading crown. In all cases, however, their branches are recurved and usually somewhat pendulous at the ends. The species best known to me, and very abundant and common in somewhat open locations in Peru and Bolivia, is *F. dependens* Hooker. I first encountered it on the road from La Paz to Coroico, Bolivia, at an elevation of about 7000 feet, and surrounded by the most magnificent scenery that can be conceived. The road at this point swept around the side of a vast horse-shoe bend, more than a mile across. Above was a long curved row of glacier-covered peaks, below which was the rich tropical foliage, denser and grander with the steady decrease of altitude. Beneath us, the vast valley sloped downward and outward beyond the reach of vision. It was the rainy season, and across the valley a number of waterfalls were in sight, most of them plunging amidst the vegetation to appear again and again lower down. Here and there small clouds of vapor

were rising from the valley and floating away against the dark-green background of the vegetation. Transferring our attention to the scenes immediately about us, we could not escape a temporary confusion at the richness and variety of the vegetation. It would be impossible for the genius of any landscape gardener to design such an effect as was attained by this natural garden. Innumerable palms and bamboos arched over and drooped from the precipitous mountain sides. Everywhere were banks of ferns, of many species, and of every size, from arborescent forms to tiny species scarcely larger than the mosses among which they grow. The faces of the rocks were draped by several species of gigantic oxalis, the long stems an inch or two in thickness at the base and bearing huge clusters of flowers, some pale-yellow and some of a rosy purple. Rock-pockets were inhabited by begonias of two species, one with huge hairy leaves, the other tuberous-rooted and with smooth roundish leaves. Small level plots were filled with beds of yellow-flowered Fagelias or Calceolarias, as more commonly known. Large-flowered Odontoglossums projected their long plumes outward from the cliffs, to curve gracefully downward among the ferns below. Doubtless an amazingly long list would have resulted from a complete enumeration of the species that might have been collected within a radius of one hundred yards. The centerpiece of all this magnificence and beauty was a fuchsia-tree, of the species last named. It was from twelve to fifteen feet in height and with a trunk diameter of several inches. Its crown was ovoid-hemispherical in shape and perfectly symmetrical, the lowest branches drooping below our faces, the upper ones successively overlapping them. At the base of this trunk I was sacrilegious enough to sit and eat my lunch, and for my dessert, I pulled down the branches and ate some of the oval purple berries, about three-fourths of an inch long, and of rather insipid flavor. Viewing this tree from a little distance, it exhibited an abundance of large clusters of rich crimson flowers against a dense background of vivid green foliage. The species is very common through all that region, but no other encounter with it could ever impress me as did this first acquaintance. Indeed, I am sure that no other experience of my life has comprehended so much of grandeur and beauty as this.

Not far from the scene of the above experience, I found

another fuchsia-tree, of somewhat similar habit, notable for its densely crowded leaves, and bearing light-red flowers. It proved to be a discovery and Dr. Britton named it *Fuchsia boliviana*. *F. hirtella* HBK., of more northern regions, is similar but has very thick leaves. *F. serraifolia* R. & P., with strongly toothed leaves, has large and showy flowers, pendulous from the axils. *F. corymbiflora* R. & P. is distinguished for its very large clusters and flowers, the latter light red at the base, deep red at the summit. It is widely distributed in the Andes, very common and abundant, and probably the most showy of the South American species of this genus. *Fuchsia arborescens* Sims, of Panama, is named for its tree-like habit. It is distinguished from the other members of this group by its small flowers, only a half inch in length, but which are produced in great abundance. *F. petiolaris* HBK., of Colombia, is peculiar among South American species for its short and broad flowers, more like the forms in general cultivation.

The fifth and last group of fuchsias to be considered is peculiarly Mexican. My astonishment on first encountering one of them will be understood when I explain that a plant in full bloom very closely resembles our deerberry (*Polycodium stamineum*) in the same condition. The plants are similarly low and spreading, grow in similar situations, have small, pale and thin leaves, and bear a myriad of tiny bell-shaped flowers densely pendulous underneath. They are mostly of pale color, pink or greenish-pink, which increases the resemblance. When I first plucked a branch from a plant of *Fuchsia thymifolia* HBK. on the side of the great cañon leading to Oaxaca, it required a minute examination of the flower before the idea of a fuchsia could suggest itself to my mind, so firmly had the idea of large and showy flowers become associated with this genus. This species has a myriad of small leaves, mostly about a half-inch long, beautifully regular in their ovate pointed form. Its flowers are only a fourth of an inch long, but nearly twice as broad, and are borne on short, though slender pedicels. This species, unlike most of the group, has flowers of a deep crimson. The remarkable smallness of the leaves of another species, not more than a fourth of an inch long, is indicated by the name *F. microphylla* HBK. Similarly, the names *Fuchsia parviflora* Zucc., *F. minutiflora* Hemsl., and *F. minimiflora* Hemsl., indicate

the great floral reduction of these species. In the first-named, the crimson flowers are nearly concealed among the leaves. *F. multiflora* Hemsl. is the one that most closely resembles our deerberry, its branches being similarly horizontal, its leaves pale-green and glaucous beneath and its innumerable small flowers of a pale rose-color. This group of fuchsias would appear to be capable of great modification and improvement by selection and breeding, and might be made very popular in conservatory decoration.

H. H. RUSBY.

ETHYLENE, OR THE GAS THAT PUTS PLANTS AND ANIMALS TO SLEEP[1]

Considering the fact that I am discussing today a very narrow field of research with plants, I could, perhaps, not choose a subject that would better illustrate the significance of plant research to man. Again I could hardly have chosen a botanical topic that would better illustrate in how many directions a very simple scientific discovery may benefit man: namely, the discovery of the effects of ethylene upon living organisms. It has taught how to avoid very considerable losses in greenhouses, dwellings, and parks, it has given to surgery its best general anaesthetic known to date—in most respects an ideal anaesthetic, and it has given the plant producer an excellent agent for forcing dormant plant organs into growth and an agent for hastening a number of growth and developmental processes in plants. With all of this the story of ethylene is not yet complete. Much is yet to be learned by further investigation.

All that I shall tell you today is, directly and indirectly, the outgrowth of an attempt to answer a question put to Doctor Lee I. Knight and myself at the University of Chicago in 1908 by a disheartened florist. "What is the effect of illuminating gas upon carnations?"

The florist had lost the carnation crop in a large range of greenhouses for three succeeding years. These losses occurred in the fall when cold weather came on and he had to close up the

[1] Abstract of a lecture given in the Museum Building of The New York Botanical Garden on the afternoon of June 15, 1924.

ventilators of his greenhouses. The third year he began detecting a slight odor of illuminating gas in one corner of the range. This led to the removal of a leaky gas pipe in the alley adjoining his greenhouses and its replacement by a new pipe in the opposite side of the alley. After that his carnation production went on without mishap.

The attempt to answer the florist's question soon revealed the fact that the buds and flowers of the carnation are very sensitive to traces of illuminating gas in the air. One part of illuminating gas in 20,000 of air kills the medium-sized buds; one part in 40,000 of air, the buds that are just ready to open, and one part in 80,000 of air causes open flowers to close ("go to sleep" never to open again) within twelve hours.

Now illuminating gas is a mixture of several individual gases, (carbon monoxide, hydrogen methane, ethylene, acetylene, etc.) formed by the destructive distillation of coal, or the "cracking" of petroleum, or both. Of the several constituents of illuminating gas ethylene is found to be the one most effective with plants. For instance, one part of ethylene in 2,000,000 of air causes the carnation to "go to sleep" in twelve hours, as would be expected if it composes 4 per cent of the gas by volume.

There is no chemical method anywhere nearly delicate enough to detect, let alone accurately determine, such small concentrations of ethylene in the air, yet various investigators in my laboratory have found other plants still more sensitive to it. The sweet pea, tomato, castor bean, salvia, and others are changed in their growth by dilutions as great as one part of ethylene in 10,000,000 of air. These plants are very delicate detectors of traces of illuminating gas or ethylene in the air. It should be emphasized that some plants on the other hand are not injured or changed in their growth by considerable concentrations of illuminating gas or ethylene. This is true of Canna, Calla, and Easter Lilies, several sorts of ferns and a number of other plants.

The roots of plants are also injured by illuminating gas in the soil. Here too we found that ethylene is the most effective constituent of the gas. While it takes much higher concentrations of gas to injure or kill the roots than the tops, the soil furnishes a favorable medium for building up such concentrations. It is easy to pass illuminating gas into the soil about a

tree at such rate that no odor will be detected above the ground and yet the tree will be killed within a few weeks.

I have some evidence that the findings of botanists on the effects of illuminating gas on plants have not always been gratefully received by gas companies but it has certainly led to general good by inducing greater precautions against gas injury to plants.

The housewife can benefit by heeding the effect of escaping gas from defective fixtures upon potted and cut flowers in the home and botanists have learned to avoid the effects of "laboratory air" upon the plants they are studying. The greenhouse producer and the park keeper should be mindful of this insidious destroyer.

Doctor Luckhardt, an animal physiologist at the University of Chicago, asked the question, "If ethylene has such remarkable effects upon plants, how does it affect animals?" Contrary to the situation with many plants he finds low concentrations without effect on animals; but when it is applied in concentrations of 80 to 85 per cent in combination with oxygen it is a wonderful anaesthetic. It lacks, or has in only a low degree, the bad qualities of the commonly used anaesthetics—ether, chloroform, and nitrous oxide. It has no lethal action, does not induce sweating, and produces little nausea or gas pains. One recovers from this anaesthetic very quickly, so quickly, indeed, that incision pains are often still felt. It promises to displace completely the older anaesthetics for many types of surgical operations.

Now it happens that when any carbon compound is burned with insufficient oxygen, or with an excess of oxygen but a low temperature, combustion is incomplete and some reduced gases, such as carbon monoxide and ethylene, are formed. This occurs in the burning of a sheet of paper, a kerosene stove, a brush pile or a pile of rubbish. It also occurs in an operating gasoline engine.

For many years kerosene stoves have been burned in citrus fruit curing houses of California, Alabama and Florida for yellowing the fruits. A decade ago it was shown that these stoves were mainly effective not because of the heat they produced but because of some carbon vapor or gas resulting from incomplete combustion of the kerosene. The exhaust from an automobile engine is likewise effective. These stoves proved unsatisfactory

in many respects. They needed much attention, were the source of numerous fires, often blackened the fruit with soot and gave very irregular results, depending upon the sort of stove, trim of the wick, and height of flame. About two years ago the citrus producers asked the United States Bureau of Chemistry to determine the constituent of the kerosene stove smoke that was effective in order that they might avoid the troubles mentioned above and carry on the yellowing under controlled conditions. Doctor F. E. Denny was set at the job and found ethylene the effective agent. He finds that ethylene can be effectively used in concentrations varying from 1 part in a million up to 1 part in 5,000 of air and through a considerable range of temperature. He has worked out a simple practical method of citrus fruit yellowing by the use of ethylene and this method is now generally adopted in California. It avoids all the difficulties of the kerosene stove method mentioned above, produces the yellowing in about one half the time and puts the process under the exact control of the producer.

Doctor Denny's work suggests that, at lower concentrations of the gas and lower temperatures, the buttons remain on the fruit, a feature desirable for California fruits because of the greater market value of buttoned fruit; and that at higher concentrations of gas and higher temperatures the fruit is disbuttoned. This feature is desirable for Florida and Alabama fruit because disbuttoned fruit is much less subject to stem-end rot. If this is borne out by later work the method can be varied to meet both situations.

A number of years ago an accidental fire in the basement of a greenhouse in the Azores showed that the smoke collecting in the greenhouse above gave quick regular ripening of the pineapples growing there. As a result of this experience it is a regular practice in the Azores now to build smudges in greenhouses to get timely and regular ripening of the pineapple crop. The great amount of work done on the effect of ethylene on plants leaves little doubt that the smoke is effective through the ethylene it contains. Probably better results can be attained by releasing a little ethylene into the greenhouse.

The anaesthetics, chloroform and ether, were formerly the best known agents for forcing dormant plant organs into immediate growth as well as for hastening plant processes and

plant development. The main drawback with them is that there is a narrow margin between the concentration that will force and the concentration that will kill. In other words, the poisonous or lethal factor is high in these anaesthetics. As Doctor Luckhardt has found for animals and human beings and Doctor Denny for citrus fruits, the lethal factor in ethylene is low. In citrus fruits, for instance, ethylene can be used over a wide range of effective concentrations without injury. On this account it promises to be much superior to ether and chloroform as a forcing agent for the plant producer. It is also possible that further investigation will show that some closely related compounds, such as acetylene, propylene, etc., are still more effective.

WILLIAM CROCKER,
Director, Boyce Thompson Institute for Plant Research.

THE ROSE GARDEN, 1924

(WITH PLATE 295)

On account of cool and rainy weather the rose season of 1924 was nearly two weeks late. Conditions made for two features. Our flowers were never better in size and substance; on the other hand, many beautiful varieties developed large full buds which became "bull-headed" and never opened. Then the first supplementary growth of flowering wood started on normal season time, so that as soon as the main crop of roses was gone, the first week of July, the second crop of blooms started, and kept the garden in color for another month. Strong canes on the bushes give promise of a big September crop of flowers, and plenty before that.

Coming in when New York was entertaining many visitors, the Rose Garden was an attraction to many. One noticed visitors from states not particularly famous for roses, notably Florida, residents of which had been successful with a certain few and looked over other sorts to try out. Mr. Robert Casamajor, of Pasadena, California, noticed many varieties doing well for us which were not so good in California. Dr. Edmund M. Mills, President of the American Rose Society, and Mr. L. C. Bobbink of Rutherford, N. J., honored us with a special visit at the time of the American Rose Society pilgrimages. They

were looking over several varieties given to us by Bobbink and Atkins which were not new but rather uncommon. The Rose Garden now contains more than 5,000 plants and the variety has been increased by the following sorts:

Hybrid Tea and Pernetiana Roses

Aladdin, HT. (W. Paul & Son, 1916.)
Alfred W. Mellersh, HT. (W. Paul & Son, 1918.)
Burgemeester Sandberg, HT. (G. A. van Rossem, 1919.)
Charles K. Douglas, HT. (H. Dickson, 1919.)
Charming, Per. (G. A. van Rossem, 1921.)
Edel, HT. (S. McGredy & Son, 1919.)
Ethel Somerset, HT. (A. Dickson & Sons, 1921.)
Étoile de Feu, Per. (Pernet-Ducher, 1921.)
Independence Day, Per. (Bees, Ltd., 1919.)
Margaret M. Wylie, HT. (H. Dickson, 1921.)
Mrs. Henry Morse, Per. (S. McGredy & Son, 1919.)
President Wilson, Per. (Easlea, 1918.)
Rev. F. Page-Roberts, HT. (B. R. Cant & Sons, 1921.)
Secretaris Zwart, HT. (G. A. van Rossem, 1918.)
Souvenir de Claudius Pernet, Per. (Pernet-Ducher, 1920.)
Souvenir de H. A. Verschuren, HT. (H. A. Verschuren & Sons, 1922.)
Sunny Jersey, Per. (Le Cornu, 1918.)

Hardy Climbing Roses

Adélaide Moullé, HW. (Barbier & Co., 1902.)
Alexandre Girault, HW. (Barbier & Co., 1909.)
Auguste Roussel, H. Mac. (Barbier & Co., 1913.)
Aunt Harriet, HW. (Van Fleet, 1918.)
Baronesse van Ittersum, HM. (M. Leenders & Co., 1911.)
Bess Lovett, HW. (Van Fleet, 1905.)
Blush Rambler, HM. (B. R. Cant & Son, 1903.)
Bouquet Rose, HW. (Theunis, 1911.)
Casimir Moullé, HW. (Barbier & Co., 1910.)
Christian Curle, HW. (Cocker & Sons, 1909.)
Climbing Cecile Brunner, HM. (Sport at Riverside, Calif., 1901.)
Climbing Helena,

Climbing Orleans, HM. (Levavasseur & Sons, 1913.)
Coronation, HW. (W. Paul & Son, 1919.)
Dawson. (Dawson, 1888.)
Daybreak, HW. (Dawson, 1909.)
Duchesse d'Auerstaëdt, HT. (A. Bernaix, 1888.)
Dorothy Dennison, HW. (Dennison, 1909.)
Dorothy Perkins, HW. (Jackson & Perkins, 1902.)
Dr. Henri Neuprez, HW. (Tanne, 1913.)
Dr. Huey, HW. (Thomas, 1914.)
Eisenach, HW. (Kiese, 1910.)
Elisa Robichon, HW. (Barbier & Co., 1901.)
Eugène Jacquet, HW. (E. Turbat & Co., 1916.)
Evangeline, HW. (Walsh, 1916.)
Empress of China, Ben. (Elizabeth Nursery Co., 1896.)
Evergreen Gem, HW. (Manda, 1889.)
Excelsa, HW. (Walsh, 1908.)
Flame, HW. (Turner, 1912.)
Frau von Brauer, HW. (P. Lambert, 1910.)
Freifrau von Marschall, HW. (P. Lambert, 1913.)
Garisenda, HW. (Bonfiglioli, 1911.)
Gerbe Rose, HW. (Fauque & Sons, 1904.)
Gertrude Rochfort,
Grace Thompson,
Jean Girin, HW. (Girin, 1910.)
Jean Guichard, HW. (Barbier & Co., 1905.)
Joseph Liger, HW. (Barbier & Co., 1909.)
Klondyke, HW. (W. Paul & Son, 1911.)
Lady Gay, HW. (Walsh, 1905.)
La Guirlande, HW.
Minnie Dawson, HM. (Dawson, 1896.)
Miss Flora Mitten, HW. (Lawrenson, 1913.)
Miss Helyett, HW. (Fauque & Sons, 1909.)
Mme. Auguste Nonin, HW. (Nonin, 1912.)
Newport Fairy, HM. (Gardner, 1908.)
Non Plus Ultra, HM. (Weigand, 1904.)
Paradise, HW. (Walsh, 1907.)
Paul Noel, HW. (Tanne, 1913.)
Paul's Scarlet Climber, HW. (W. Paul & Son, 1916.)
Purple East, HM. (Paul & Sons, 1901.)
Renée Danielle,. HW (P. Guillot, 1914.)

Roserie, HM. (Witterstaetter, 1917.)
Rowena, HW. (W. Paul & Son, 1912.)
Shalimar, HW. (J. Burrell & Co., 1914.)
Silver Moon, HW. (Van Fleet, 1910.)
Souvenir de l'Aviateur Metivier, HW. (Tanne, 1913.)
Souvenir de l'Aviateur Olivier de Montalent, HW. (Tanne, 1913.)
Starlight, M. (W. Paul & Son, 1909.)
Steiler Rambler, M. (M. Leenders & Co., 1915.)
Waltham Bride, HM. (W. Paul & Son, 1903.)
Wartburg, HM. (H. Kiese & Co., 1910.)
Wedding Bells, HM. (Walsh, 1907.)
White Dorothy (White Dorothy Perkins), HW. (B. R. Cant & Sons, 1908.)
Wichmoss, HW. (Barbier, 1911.)
Trier. (P. Lambert, 1904.)

Climbing Hybrid Tea Roses

Carmine Pillar, Cl. HT. (W. Paul & Son, 1895.)
Climbing Étoile de France, Cl. HT. (Howard Rose Co., 1915.)
Climbing Gen. MacArthur, Cl. HT.
Climbing Lady Ashtown, Cl. HT. (Bradley, 1909.)
Climbing Mrs. W. J. Grant, Cl. HT. (W. Paul & Son, 1899.)
Climbing Paul Lédé, Cl. HT. (Stuart Low & Co., 1913.)
Climbing Richmond, Cl. HT. (A. Dickson & Sons, 1912.)
François Crousse, Cl. T. (P Guillot, 1900.)
Gloire des Rosomanes, Cl. Ben. (Vibert, 1825.)
Reine Marie Henriette, Cl. T. (Levet, 1878.)

Kenneth R. Boynton.

ROSES AND THEIR CULTURE[1]

The rose has sometimes been called "the world flower." It is quite correct to say that for centuries the rose has been the most universally popular flower, at least in the civilized nations of the North Temperate Zone,—the nations that have made the world's history and the world's literature. The poets of all ages

[1]Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden, on Saturday afternoon, June 28, 1924.

have noted the rose in the maiden's cheek. None has ever seen there the pink tulip or the flaming rhododendron! As an appellation for girl babies the rose vies with the violet in popularity. So far as the speaker has learned, no girl baby was ever named "Dahlia" or "Chrysanthemum!"

The rose occurs in nature in a multitude of species, varieties, and forms. Botanists have been divided as to whether to recognize as many as two thousand or only fifty valid native species, but the preponderating scientific opinion of the present day recognizes somewhat more than one hundred good natural species, natives of the North Temperate Zone and of the mountains of the tropics. A dozen or fifteen of these occur in the northeastern United States. Our cultivated varieties rarely match up accurately with the native species. Most of them represent crosses or hybrids of two or more species—often very complicated crosses, involving several or many species. In case of many of the older varieties, no records of their origin or ancestry are in existence and their pedigree may only be guessed at from the characters that they now exhibit.

A cablegram published in *The New York Times* on June 20 announced the blooming of "14,000 varieties" of roses in the famous Bagatelle Gardens near Paris. Possibly a cipher was accidentally added in the process of transmission or it may be that the word "varieties" got substituted for the word "plants." According to the recently published "Standardized Plant Names," and excluding the names there designated as synonyms, 1967 varieties of roses, probably including nearly, if not quite, all the worth-while European kinds, are cultivated or offered for sale in the United States.

The lecturer began by showing photographs of some of our native roses, which, like all wild roses, are of the single-flowered type. The flowers of our native single roses, though charming, are as a rule not sufficiently numerous to make the mass effects of color that the general rose-loving public demands. The first strictly American garden rose, parentage unknown, but probably a descendant of the Prairie Rose, is said to be one planted by Washington at Mount Vernon and named by him Mary Washington in honor of his mother. It has been claimed that the oldest rose garden in the United States is the one at the Van Cortlandt Manor, Croton-on-Hudson. The old loop-hole-pierced

manor-house bears the date "A. D. 1681." The date of the beginning of the garden is unknown, but it is surely more than a century old. The garden includes great bushes of the Damask, Centifolia, and other old-time roses, such as the famous variegated "York and Lancaster" variety.

Roses need choice locations, well exposed to sunshine and protected from winds. They are heavy feeders and thrive best on rich, well-drained soil. A southeast exposure is considered most favorable when climbers are to be trained up against a house or barn. Of the two thousand varieties of roses now on the American market, the ordinary home-gardener wants to grow only one or two dozen of the best kinds. In a mail vote by members of the American Rose Society on the question, "What roses have done the best for you in 1921?" the variety Dr. W. Van Fleet was overwhelmingly first among the hardy climbers, followed by American Pillar, Silver Moon, Climbing American Beauty, and Dorothy Perkins. All these roses are of American origin. Dr. W. Van Fleet has beautiful, large, flesh-pink flowers on vigorous plants with polished glossy leaves which are resistant to mildew and other fungous and insect enemies of the rose. In this same symposium of the American Rose Society, the variety Radiance was the first choice in the Hybrid Tea class in the Northeastern, Middle, and Southern States, with Ophelia standing second, while in the Central States Gruss an Teplitz was the ranking favorite, with Ophelia again second. In the Hybrid Perpetual class, the variety Frau Karl Druschki held first place in popular favor in all localities, with George Arends and General Jacqueminot (the familiar "Jack Rose") close rivals for second choice.

MARSHALL A. HOWE.

NESTING OF THE HUMMINGBIRD

On May 30th, a hummingbird's nest was observed in the Botanical Garden near the Boulder Bridge, built on the drooping branch of a red maple directly over the water of the Bronx River. It was in such a position that any one standing on the bridge could look down upon it and readily see one of the eggs in the bottom of the nest at a distance of not more than nine

or ten feet away. When first found, although only one egg was seen, doubtless both eggs had been laid for several days, for on visiting the nest on the morning of June 11th, evidently the second of the two eggs had hatched out sometime during the night, the first young bird having come out probably two days earlier. At first the young grew rather slowly and seemed quite helpless for the first eight or nine days, with plenty of room in the nest. Not until about June 25th did the birds begin to crowd each other, one bird seeming quite a bit larger than the other, and always sitting well above its mate. June 28th the larger bird was seen almost constantly preening itself, vibrating its wings and at times almost rising out of the nest. The next day both birds were quite active, frequently shifting their positions, sometimes facing in the same direction, sometimes in opposite directions and both had grown so large that the nest seemed none too big for one alone. June 30th, the birds were on the nest in the morning, but somewhere between two o'clock and five o'clock in the afternoon, the larger bird disappeared not to be seen again in the vicinity. The smaller bird, with the nest to itself and plenty of room and food now seemed to grow more rapidly. It remained in the nest about two days after its mate had gone, however, the old bird being seen feeding it for the last time the evening of July 2nd. The next morning by seven o'clock both birds were gone and not observed again about the premises. From the above it seems the young are about three weeks old before attaining power of flight. No male bird was seen at any time during these observations. The nest itself, saddled over a branch about one half an inch in diameter, at a point where a much smaller branch grew out, was considerably shallower and greater in diameter when deserted than when containing eggs. This was owing to the stretching of the rim by the growing birds as well as to the old and young birds frequently perching on the rim and flattening the nest out to a noticeable degree. In its present condition the cavity of the nest measures one and one-eighth inches across and seven-sixteenths inches deep. When first noticed it seemed to have a depth nearly equal to its diameter at the rim. It is made of about the usual materials. A soft, felty, vegetable fiber constitutes the bulk of the nest, the outside being covered with bits of lichen and bark more or less bound together with spider's webs.

R. S. WILLIAMS.

THE FLOWER BEDS[1]

The groups of rectangular gardens north of Conservatory Range No. 1 are used to display a collection of bulbous, perennial, and annual herbaceous flowers. These include the flowers particularly available for the small garden, for the beginner's garden, and for the permanent garden requiring the least attention. These flowers have a background of evergreens and flowering shrubs. The main portions of the beds are devoted to perennials, the remaining areas contain flowering bulbs in the spring and annual flowers in the summer. Representatives of most of the kinds of flowers one finds in the seed catalogue are planted and labeled, including the so-called old-fashioned flowers, Hollyhock, Larkspur, Marigold, Petunia, and Zinnia.

Those who care for plants with gray or white foliage will find the Rose Campion, Roman Wormwood, Lavender Cotton, Woolly Speedwell, Hardy Pink, and the Woolly Betony. The foliage plants displayed are Alternanthera, Achyranthes, Coleus in variety, Perilla, Variegated Gout Weed, Sanchezia, Snow-on-the-mountain, and Pelargoniums with spotted leaves. Many of these foliage plants came from warm countries and they must be raised in greenhouses by cuttings, so are not adapted to the ordinary garden. Others from the tropics, grown readily from seed, and free flowering, are the Portulaca or Sun plant, the French Marigold and African Marigold, which are both native of Mexico, Salvias, Flower-of-an-Hour, Cosmos, Cock's-comb, and Zinnia. Two everlastings are grown, the Australian, called straw-flower, which comes up again each year from its own seed and furnishes its durable flowers for winter bouquets, and the Rose Everlasting, which is also from Australia, but is not so simple in culture. Hollyhock, Larkspur, and Snapdragon, Calliopsis, Cornflower, and Day Lily, all the old favorites, are growing in our flower beds, with a sprinkling of roses, chrysanthemums and other flowers which are shown to better advantage in groups. These were studied in the field as it were, some account being taken of their methods of growth and propagation.

KENNETH R. BOYNTON.

[1] Walks and Talks in The New York Botanical Garden—V. The Flower Beds. Saturday afternoon, July 12, 1924.

NOTES, NEWS, AND COMMENT

Dr. Ralph R. Stewart, the missionary botanist, who has been studying the botany of the Western Himalayas for the past twelve years and has been spending several months at The New York Botanical Garden in going over his collections, lectured at the Garden on Saturday afternoon, May 3, on "Plant collecting in Western Tibet." Dr. Stewart has three times crossed the great range of the Himalayas into Little or Western Tibet. This is a part of Tibet which was conquered by the Dogras of Kashmir and belongs to the State of Kashmir. One summer he traveled 800 miles on foot, going into the mountains in Kashmir and coming out at Simla. In his lecture Dr. Stewart described the methods of transport used in Tibet, the methods of agriculture, the foodstuffs commonly used, the monasteries or lamaseries and the life of the nomads. In the interior the yak is the chief burden-bearer, although large numbers of horses and mules are also used. Methods of agriculture are most primitive, the grain being pulled up by the roots by hand. The country is on the whole so rugged and barren that what little cultivation there is, is dependent on irrigation. The country is without forests and each village has to raise willows and poplars by irrigation to obtain a supply of poles for making the roofs of their houses. The snow line is very high and a few plants are found up to 18,000 feet. Dr. Stewart found 80 species of flowering plants above 15,000 feet. Dr. Stewart used about 75 colored slides to illustrate his lecture, including a number of slides of the interiors of monasteries and pictures of the famous monastery at Himis, where the devil dance is held annually.

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LIBRARY ACCESSIONS FROM MARCH 1 TO JUNE 30, 1924

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Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A **museum**, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An **herbarium,** comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A **library** of botanical literature, comprising more than 34,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

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Patron	single contribution	5,000
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BRONX PARK, NEW YORK CITY

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NOTES, NEWS, AND COMMENT

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On Big Pine Key, Florida.—A silver-palm (*Coccothrinax argentea*) singled out to show its maximum development on the Florida Keys. The higher parts of Big Pine Key are occupied by a pine-palm association disposed in three stories—an upper story of slash-pines (*Pinus caribaea*), a middle story of silver-palms and thatch-palms (*Thrinax microcarpa*), and a lower story of saw-palmettos (*Serenoa repens*). The development of palms—silver and thatch is phenomenal when it is considered that the trees grow directly on the plate-like surface of the oölitic limestone.

oolitic limestone.

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THE SILVER-PALM—COCCOTHRINAX ARGENTEA

(WITH PLATES 296 AND 297)

A century elapsed between the period when this elegant palm was first popularly described and that when it was botanically published. Under the heading "The Silver Leaf Palmetto" Mark Catesby[1] wrote:

"The usual height of these trees is about sixteen feet. The leaves somewhat less than the preceding [the thatch-palmetto], but thicker set, of a shining silver colour. Of the leaves of these trees are made ropes, baskets, etc. The berries are large and sweet, and yield a good spirit."[2] This reference is to the silver-palm in the Bahamas.

However, this tropical palm, notwithstanding its wide distribution and striking characteristics, seems to have figured but little in botanical literature. As far as we can learn, the

[1] Mark Catesby was born in 1679, at Sudbury, Suffolk, England. From 1712 to 1719 he was in Virginia; during this time he collected numerous scientific specimens, sending the botanical ones to Dr. Samuel Dale (1659–1739), of Braintree, in Essex. Upon his return to England, he was encouraged by promises of financial support from various sources to visit America again for the express purpose of studying and painting natural objects. He arrived in Charleston in May, 1722, and remained there for some time, exploring the vicinity and even the interior; he then went to Georgia and Florida, and, in 1725, to New Providence, where he maintained his headquarters while visiting several other islands of the Bahama group. In 1726, he returned to England, and spent the remainder of his life, more than twenty years, in engraving and coloring with his own hand his monumental work, "The natural history of Carolina, Florida, and the Bahama Islands." This was published in eleven parts of twenty plates each, with descriptive text, from 1730 to 1748. Catesby died in London, 23 December 1749.—JOHN HENDLEY BARNHART.

[2] The Natural History of Carolina, Florida and the Bahama Islands, XLI. 1731.

species was first described and published botanically in 1830 from a specimen sent by Loddiges from England to the Munich Botanical Garden. The origin of this specimen seems to be unknown.

The silver-palm represents one of the many species of flowering plants whose recorded existence in the United States—southern Florida mainland and islands of the reef—was delayed until the comparatively late exploration of the Everglade Keys and the Florida Keys was undertaken.

It was not until within the seventies of the last century that this plant was definitely collected and recorded as a member of the flora of the continental United States. The collection on which this first record is based was made by A. P. Garber[1] on the Everglade Keys. The specimens were made the type of a species—*Thrinax Garberi*—by A. W. Chapman[2] in 1878 and were recorded as coming from "Rocky pine woods near Miami, South Florida."[3]

In 1883 and 1884 the palm became more prominent in literature and appeared under two names, if not under three, instead of under one.

A. W. Chapman, in 1883,[4] interpreted it as two species, *Thrinax argentea*, Keys of South Florida (Curtiss) and *T. Garberi*, Rocky pine woods, Miami, South Florida (Garber). It is suspected that Chapman's "*Thrinax parviflora* Swartz" also contained some material belonging to the silver-palm.

[1] Abram Paschall Garber was born 23 February 1838, at Columbia, Pennsylvania. He was graduated from Lafayette College in 1868, and studied medicine at the University of Pennsylvania, receiving his degree in 1872. He went to southern Florida as a health-seeker about 1877, and while there devoted much time to the collection of the plants of that region, whose flora was then little known. In 1880 he also collected plants in Porto Rico. In 1881 he returned to Pennsylvania, and died there, at Renovo, the same year, 26 August.—J. H. B.

[2] Alvan Wentworth Chapman was born 28 September 1809, at Southampton, Mass. He was graduated from Amherst College, where he attended Amos Eaton's lectures on botany in 1831, and spent the next few years as a teacher in Georgia, where he studied medicine. He removed to Florida in 1835, and was a physician at Apalachicola from 1847 until his death more than fifty years later. The first edition of his famous "Flora of the Southern United States" was published in 1860. He died at Apalachicola, 6 April 1899, in his ninetieth year.—J. H. B.

[3] Botanical Gazette 3: 12. 1878.

[4] Flora Southern United States, Ed. 2, 651. 1883.

C. S. Sargent,[1] in 1884,[2] interpreted the plant under two names, *Thrinax parviflora*, "Semi-tropical Florida, southern keys from Bahia Honda to Long's [Long] Key; in the West Indies," referring Chapman's *Thrinax Garberi* here as a synonym, and *Thrinax argentea*, "semi-tropical Florida, on a nameless key 10 miles west of Key West, Elliott's Key, Key Largo, Piney [Pine] Key, Boca Chica Key, Key West, Garden Key, and on the small keys south and west of Bahia Honda Key (Curtiss); in the West Indies."

In 1894 a plate representing this species (excluding the leaf on the plate) was published under the name of *Thrinax parviflora* and the distribution cited as "In Florida *Thrinax parviflora* has been found only in the southern keys from Bahia Honda to Long's [Long] Key, usually growing in low, moist, sandy soil, or in sandy swamps. It also inhabits the Bahama Islands and many of the Antilles".[3]

In 1897 Chapman reduced his *Thrinax Garberi* to a variety of *T. argentea*.[4]

In 1899 C. S. Sargent described the genus *Coccothrinax* and proposed a new species—*C. jucunda*—as the type. Continuing after the descriptive matter, he records that the palm grows on:

"Dry coral ridges from the shores of Bay Biscayne, where it is rare, along many of the southern keys to the Marquesas group, west of Key West. Discovered by A. H. Curtiss[5] in

[1] Charles Sprague Sargent was born 24 April 1841, at Boston, Massachusetts. After graduation from Harvard University in 1862, he entered the army, leaving the service at the end of the Civil War, as brevet major of volunteers. He has been director of the Arnold Arboretum, at Jamaica Plain, Massachusetts, since its establishment in 1872, and has thus devoted about fifty years to the study of woody plants. His work in the development of the Arboretum, and his numerous elaborate publications, have made his name familiar to all botanists and tree-lovers.—J. H. B.

[2] Forests of North America 217, 218. 1884.

[3] C. S. Sargent, Silva 10: 51. 1894.

[4] *Thrinax argentea Garberi* Chapman, Flora Southern United States, Ed. 3 462. 1897.

[5] Allen Hiram Curtiss was born 9 February 1845, at Central Square, Oswego County, New York. In his youth the family removed to Virginia, where he began to collect plants for distribution. In 1875 he settled in Florida, which was his home for the remainder of his life. For many years he was a professional collector, and his specimens, with printed labels, are to be found in nearly all the large herbaria of the world. He was the discoverer of many of

1880. Very similar to *Thrinax argentea* R. & S., the seeds differing, however, from those of that species as named in the herbarium of the Royal Gardens, Kew, in their brown, not mahogany-red, color and larger size."

Here *Thrinax Garberi* is transferred to the genus *Coccothrinax* and treated as a species, and followed by this note:

"A stemless plant similar to the last in the structure of its flowers and fruit and in the texture and color of the leaves, but smaller in all its parts, the leaves being only about ten or twelve inches in diameter. Found only on dry coral ridges near the shores of Bay Biscayne, and possibly only a depauperate form of the last."[1]

A few years later the matter in the above quotation relating to *Coccothrinax jucunda* is paraphrased as follows:

"*Coccothrinax jucunda* is now known only in Florida, where it inhabits dry coral ridges and sandy flats from the shores of Bay Biscayne, along many of the southern keys, to the Marquesas group west of Key West.

"The stems are used for the piles of small wharves and for turtle crawls, and the soft tough young leaves are made into hats and baskets.

"*Coccothrinax jucunda* was discovered in 1880 by Mr. A. H. Curtiss on Bahia Honda Key. The specific name is in allusion to the sweet edible flesh of the fruit."[2]

The ancestors of the Florida silver-palm were evidently immigrants from the West Indies. It has not made much progress northward in the ages since its arrival this side of the Gulf Stream. The rigors of the Florida climate have been against its advance. This condition can be observed in its natural geographic range in the State. The variations caused merely by the different climatal conditions throughout only a few miles of latitude were of sufficient prominence to lead to the describing of two species (*Coccothrinax Garberi* and *C. jucunda*), whereas it is now clear that only one species really exists within our range.

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the plants of southern Florida. During the last five years of his life he extended his activities to parts of the West Indies. He died at Jacksonville, 1 September 1907.—J. H. B.

[1] C. S. Sargent, Botanical Gazette **27**: 90. 1899.

[2] C. S. Sargent, Silva **14**: 87. 1902.

On the Everglade Keys near Homestead, Florida.—The tallest silver-palm (*Coccothrinax argentea*) observed on the Florida mainland. The primeval pine forest has been cut away in the foreground. Partly thinned pinewoods may be seen in the background flanking a vista through which a line of original forest may be observed. Here the conspicuous vegetation is a pine-palm association—an upper story of slash-pines (*Pinus caribaea*), a middle story of silver-palms (*Coccothrinax argentea*), and a lower story of saw-palmettos (*Serenoa repens*). The saw-palmetto may be seen as a complete ground cover on the roughly eroded oölitic limestone.

On the Florida Keys, which floristically are typically West Indian, we find the silver-palm growing just as it does on the islands southeast of the Gulf Stream. The gray symmetrical stems are tall, ten to twenty feet or more, and terminate in a crown of many gracefully placed leaves, which are dark-green and glossy above and silvery beneath.

When we pass a little further north onto the mainland and the Everglade Keys we meet the silver-palm again. On the more southern parts of these keys, in the so-called homestead region or Redlands district, where, apparently, the weather is more evenly tempered than it is a little further north in the Miami region, the silver-palm trees a decade ago and formerly, preceding the devastation of the region by the homesteaders, reached only about one half the development that they do on the lower Florida Keys. Palms with stems six to ten feet tall were not uncommon. Thence northward to the Miami River, which marks the natural northern geographic limit of the species, the palms become lower and lower until, as a rule, the great majority of the individuals are acaulescent, that is, with short stems that do not rise above the surface of the soil, and the crown consists of only a few leaves which are much reduced in size compared with those of the more southern Everglade Keys and the lower Florida Keys. It might be argued that the difference in size and general development is due to good and poor soil. The facts are, that in the region of maximum development of the silver-palm in Florida, soil is nearly or quite absent. The best specimens and groves of the palm trees grow on the plate-like surface of the Key West oölitic limestone on the lower Florida Keys. Likewise the best development of the species on the Everglade Keys is where the soil is thinnest and apparently poorest.

An instructive case of the migration of a native plant was recently observed in the case of the silver-palm. Within the past few years the geographic limit of the species has been extended northward over seventy miles, or over a hundred miles northward of its center of development in Florida. The fruits of this palm are black and meaty, and are sought by various birds as well as by other animals.

When the coastwise canal, which extends northward from the upper end of Bay Biscayne, was dredged, sand banks were

thrown up on one side or the other of the waterway. These banks were barren but, where undisturbed, soon became clothed with herbs, shrubs, and trees representing both native local plants and those foreign to the region. Among the latter is the silver-palm. It is on the sand embankments and apparently nowhere else in the region. The migratory birds brought the seeds northward either from further south in Florida or from the West Indies. The birds either follow the course of this inland waterway closely in their flight, or seeds dropped in neighboring parts not suited to their growth do not germinate or, at least, do not survive after germination.

Of course, the higher latitude is against the natural development of this tender tropical palm northward, but the tempering effect of the canal, the lagoons, the marshes, and the nearby ocean, although slight, may be sufficient to enable the palms growing directly on the warm banks to survive the cold spells of winter and maintain a foothold.

The silver-palm has a wide distribution in the West Indies, being found in the Bahamas, Cuba, Santo Domingo, Porto Rico, the Virgin Islands, Tobago and Trinidad. It has received several different botanical names in these islands, but specimens indicate that all may be referable to one species. Several different species of the genus *Coccothrinax* occur in Cuba, however.

JOHN K. SMALL.

ORNAMENTAL SHRUBS[1]

Shrubs are woody plants that do not get to be trees, mostly two to fifteen feet in height. "Ornamental" means flowers, berries, or foliage. The late Samuel Parsons, landscape architect, New York Park Department, said, "Consider shrubs for their foliage. The flowers are only an incident." The former gardener for Charles A. Dana, William Falconer, editor of Gardening, and Superintendent of Schenley Park, Pittsburgh, said, "You young men who are studying landscape architecture at Harvard and Cornell are all right planting shrubs for green foliage, but what the American people want is a show." The

[1]Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden, June 22, 1924.

public still wants bright flowers, at the least expense. Shrubs can give the most show for the least money, trouble, and space. How to find out what to plant: come to The New York Botanical Garden or the Brooklyn Botanic Garden and look for the shrubs, walk through, not ride at thirty-five miles per hour, look closely, and remember color and form. Look for the label, write it down, look it up in nursery catalogues or better, go to a nursery. Buy the plant and take it home with you. Your grandmothers would have asked for a slip and grown the plant without cash expense. Your grandfathers would have asked for grafts or buds of apples and pears, dug up a stock, and grafted on it.

How to use flowering shrubs: as a boundary to your place, as a background for flower garden, as ground cover, as shade to the ground under trees, and as specimens for flowers or berries.

A boundary is easiest to think of as a hedge. The cheapest shrub is privet. Lazy thinking results in miles of privet hedges and aching arms and big expense to trim where there might be beautiful borders of shrubs, not monotonous privet. Privet inland in this latitude winter-kills and looks like a child who has some front teeth out. When the privet is not trimmed it produces flowers with very disagreeable smell. Mr. Theodore Foulk of the American Nursery Company, Flushing, predicted twenty years ago that people would tire of trimming privet hedges. His prediction has come true. The percentage of privet is less.

Japanese barberry is rapidly increasing as a hedge plant. It needs little or no trimming, for it rarely grows above six feet. The coral red berries are the most showy of all common shrubs, making cheerful and beautiful the winter landscape and furnishing seeds for the robins and bluebirds during their starving period before the worms and insects are ready.

Shrub borders instead of trimmed hedges are the next landscape improvement for the vicinity of New York City. How change? Throw out or give away the hedge. Few have the courage. Plant back of the hedge a shrub border and take the hedge out later.

Shrub borders can be from three to ten or more feet wide. Taller varieties can go in the back. Low varieties are not needed for all of the front border. Let the tall varieties arch to the ground.

"Succession of bloom throughout the season" is the stock remark when ordering. I am not here to teach you the refinements of landscape design. Consult a landscape architect. Or be your own landscape architect, make your mistakes and correct them. Decide how high a wall of green you want. Select from the shrubs in the Botanical Garden species that naturally reach about that height. For instance, if you wish a wall of green eight feet high you will find many of the snowball family, weigela, lilac, mock orange, and dogwoods. You will agree with Parsons that the foliage is important. You can get the height and density with many species. In the Botanical Garden, a shrub at twenty years may be fifteen feet wide. Plant six feet apart and thin out. The outline of the borders can depend on the width of your vista. Do not clutter up the place with trees and shrubs. The first essential of landscape is sky and length and breadth of view. If your lot is fifty feet wide, crowd back your shrub boundary to eight feet and struggle to keep it there. If your lawn area is one hundred feet wide the shrub border may be ten to fifteen feet wide.

If you like Forsythia or golden bell, scatter it fifty feet apart along the borders. The town of Farmingdale, Long Island, has adopted it for the village flower. I told them they could become famous and people would be glad to go over the Sunrise Trail in a few years to see the cheerful and gavly decorated town. Lilacs are favorites for perfume and old time's sake. Scatter them the same way. Van Houttei spirea and bridal wreath spirea are white. Scatter them also through the borders and your neighbors will admire the beauty of your home grounds.

Syringa or mock orange is beloved for fragrance. An old farm house would seem incomplete without syringa, lilac, sweet shrub, and Japanese quince. A sprout from these ancestral shrubs can be dug off the side of the old bush, the roots wrapped in mud, newspapers, oiled paper or burlap. The tops should be cut back. If carefully planted and watered this operation is practical any time of the year. A friendship garden or an ancestral garden is easily acquired. My mother brought from central New York the same kind of a double white rose that my grandmother brought from Syosset. Roots of peony can be carried for generations like furniture or portraits.

Summer-blooming shrubs are not so plentiful, but a chapter

on Aristocrats of the Garden by E. H. Wilson, Assistant Director of Arnold Arboretum, will surprise you with many things beyond the commonplace hydrangea and bush althea or rose of Sharon.

Autumn foliage in shrubs is not often considered because we have taller display of maple, oak, and dogwood. For autumn foliage look through the wild growth of sumac, highbush blueberry, Virginia creeper, and decide what to add to your home landscape.

Berried shrubs are worth a long chapter. Come to the Botanical Garden in the autumn and winter, make every winter walk an occasion for a winter bouquet (a mental one). For literature, see "How to Know Wild Fruits" by Maude Gridley Peterson, published by Macmillan & Co. Don't forget to plant and re-arrange in fall and winter. Birds are our best friends. Come and see the bird sanctuary at the Children's Library, Westbury, given by Mrs. Robert Bacon as a memorial to her husband, the late ambassador to France. Look up the literature of the United States Biological Survey and the American Association of Audubon Societies.

Your shrubbery can be changed from the ordinary border of cheap and commonplace varieties to the best if you will do a little thinking and take a little time for transplanting. The biggest mistake is to let your landscape stay as it is because it was planted that way. People hesitate to perform the surgical operation of transplanting. It is hard work and they feel they will kill the plant. My usual lecture is how to transplant, on your grounds, in the nursery, or from the wild.

The Wild Flower Preservation Society may say "Touch not, steal not." There are plants, and there are places from which it is right to take wild plants. Sometimes, perhaps most times, you should ask the owner. Laws in several states require written permission from the owners before laurel, climbing fern, and certain other plants can be offered for sale. The Massachusetts Legislature did not pass such a law for trailing arbutus. As I am a wicked nurseryman, perhaps I am prejudiced in favor of the privilege of collecting wild plants. I have done a great deal of it and I believe it is the best way to educate the American public to make America beautiful. Why? Because native collected plants fit the region. They are most certain to be harmonious and economical to maintain. The greatest demand

from the nursery should be for native plants. Neltje Blanchan, author of many instructive nature and garden books, has said, "It is much better to buy native plants from nurserymen, rather than collect them, because they have better roots." To collect wild plants, select small seedlings grown in the open, not big plants grown in the shade. Get big roots, keep them damp, cut back the top, water thoroughly once a week the first part of the season. What are the native shrubs sufficiently abundant in your vicinity to collect? Dogwood, laurel, azalea, arrowwood, summersweet or clethra, blackhaw or *Viburnum prunifolium*, bayberry, and wild rose come to mind. The pink azalea may be rare, don't collect it. The dogwood you see may overhang a public road. Leave it, find an abandoned pasture where they are out of sight, and where the quantity you take will not be missed.

Summer planting is a new hobby of mine. It is practical with most shrubs to dig them carefully, lift them out with ball of earth, sew them in burlap or tie them in burlap to hold the ball, cut back the top and water thoroughly and frequently. They may look a little wilted; you can cut back some of the foliage. Summer planting relieves the congestion of spring planting. It relieves the congestion in your program and the burden of remembering and doing several months later. It gives you the fun of thinking and doing.

New and unusual shrubs are not frequently offered. Why? The wholesale nurserymen grow what is already known and already salable to the retail trade. The retailer buys what he can buy the cheapest. The ultimate consumer buys but once or twice in a lifetime and is satisfied if the place looks "fixed up." The usual fixing up of suburban places consists of grading, a hedge, a few shrubs in the corner, and shrubs or evergreens at the foundation. The owner has no more thought of changing them than of changing the chimney.

You have got to make the first move for the new and better shrubs. Where is the literature? In the reports of The New York Botanical Garden are lists of shrubs. The spot where the shrubs are grown is called the Fruticetum. I thought the word suggested "fruit," but it refers to the Latin name for a shrub. "Trees and Shrubs of Central Park," and "Trees and Shrubs of Prospect Park," both by the Manhattan Press, will give

the old and more common shrubs. They have not kept up to date through lack of appropriation or fear that the people will break the flowers. This can be translated as lack of public demand due to ignorance. Highland Park, Rochester, has over 350 varieties of lilacs. The other departments and other shrubs are in proportion. Unfortunately it does not have an illustrated catalogue. The Arnold Arboretum publishes a guide and a series of popular bulletins and from them can be dug out the information you need on the best of the newer shrubs. Can somebody finance a book illustrating the new and good things?

Quarantine 37 was given as the cause of lack of novelties at the Flower Show. It is more particularly the cause of lack of the best rhododendrons, azaleas, evergreens, and flowering shrubs. If you want what is best, ask for it. You will not always get the best things, because they are difficult to get and difficult to propagate and often do not sell at a profit.

Don't hesitate to ask to see shrubs, etc., on private estates. I doubt if your intrusion on private grounds to ask about plants will be resented one time in twenty. People who have beautiful grounds and beautiful plants like to share their joys.

In improving your own grounds don't hesitate to move almost anything at almost anytime of the year. That is my hobby and I believe my conceit pardonable if I claim some credit for changing landscape planting from spring and fall to all the year.

Ornamental shrubs can be either the most or least important part of your landscape and very properly so. One place should have decoration with annuals, bulbs, and perennials; another with shrubs; and another with trees. Another may be nature let alone, as on the Shinnecock Hills, Long Island, Wherever you are, you are learning to understand and enjoy the earth and sky. Knowledge of the shrubs will help you as much as knowledge of geology, if you use the New York Walk Book.

Mr. George Nash, the late Head Gardener of The New York Botanical Garden, once said, "There is no royal road to knowledge." He still relied on the analytical keys of botany. There are, however, many short cuts to the names of shrubs. You may know plants with or without a name, but a name is a convenient handle for knowledge and enables you to make your home surroundings more quiet, useful, and beautiful.

HENRY HICKS.

COLORATION IN ORNAMENTAL FOLIAGE PLANTS[1]

In a walk through the greenhouses and about the grounds of The New York Botanical Garden one sees many different kinds of plants having gayly colored leaves. The range of colors, the diversity of their combinations, and their arrangement in patterns make these plants especially attractive and valuable as ornamentals.

In regard to the kinds of coloration we may group plants with colored foliage into two main classes: in one there is a loss, or change, or substitution in the green coloration so that portions of the leaves or even entire leaves are white or of some shade of yellow; in the other there is some shade or grade of red or blue coloring material. Both these kinds of coloration may be present in the same leaf but they are quite distinct in nature and in origin. In fact, the chemist finds that yellow pigments and also certain red pigments which give quite the same appearance to leaves may be very different in composition.

The normal color of the leaves of the greater number of the higher forms of plant life is green. This is due to the presence of a coloring material or pigment technically called chlorophyll—a word that means leaf-green. For the proper development of this pigment light is necessary and certain food materials such as iron salts must be available to the plants. Also, certain internal structures of the plant or, we may say, of the cell mechanism must be present and in proper working order. Loss of green may, therefore, be due either to external or to internal conditions.

The green pigment in plants performs a very vital function in the work of making food. It absorbs certain wave lengths of sunlight and this supplies energy to the living cells for the making of simple sugars—the first step in the building of all plant and animal foods. Thus, in general, the presence of green indicates that a plant can make its own food. The absence of green in plants which are usually green very often indicates an unhealthy condition.

As to the intensity of the loss of green, there may be partial loss giving some shade of yellowish green or there may be com-

[1]Abstract of lecture given in the Central Display House, Conservatory Range 2, on Saturday afternoon, March 1, 1924.

plete loss, giving white. As to time of appearance the change may be permanently uniform for groups of cells or it may develop with age. As to arrangement, the entire leaf may exhibit the change in color, or this may occur only in certain parts, giving patterns such as the striped, the marginal, the centered, the blotched, and the veined or reticulated patterns.

Perhaps one of the most interesting of variegations is the infectious type—which may be transmitted to plants previously all green. The delicately and finely blotched variegation of the flowering maple (*Abutilon*) can be transmitted to certain all-green Abutilons by grafting onto them a branch from a variegated plant. The variegation in some species is so infectious that it is easily spread from plant to plant by insects. In tobacco, in potato, and in other crop plants infectious variegation or "chlorosis" frequently does much damage. There are many grades or degrees of infectious variegations. In some of these it is thought that certain minute living organisms are present and that their activities are associated with the loss of green. The blotched type of variegation in several of our ornamentals is known to be infectious.

Another rather definite type of variegation is that with a white-bordered pattern. If one closely examines a leaf with such a pattern, one observes that in addition to the conspicuous white margin about the leaf there is a layer or coating of white over the green both on the under side and on the upper side of the leaf. This is also true of the stem. The plant has a central core of green tissue which is covered by a layer of white tissue. When new leaves develop, the individual cells of the two kinds of tissue multiply and keep their relative positions with remarkable regularity. But occasionally the green tissue breaks through the enveloping white and a purely green branch appears. The reverse may also happen. (Several cases of these so-called bud sports were exhibited.) Many of the striped variegations seen in such plants as the agaves and the grasses are likewise due to the grouping of tissues that are permanently green or white. In this type of variegation there are two kinds of cells, one green, the other with white, or with pale green, and the grouping of these two gives the pattern.

Aside from the two types of variegation already mentioned, there is a wide range and variety of patterns which appear to

be associated with chemical and physical changes that occur. In many of these the color changes develop according to the age of the leaves.

Turning one's attention to the red and the blue colorations, we note also a great diversity in the amount of color, in its quality and intensity, and in the arrangement in patterns. While these pigments are made by plants their development is greatly influenced by such external agents as light. There is also much variation from bright crimson to dark blue according to the relative acidity or alkalinity of the sap. But whether a plant will be almost solid red, as the garden beet, or have only red blotches on the leaves, or not be red at all, is chiefly a matter of the hereditary nature of the plant.

The group of red, blue, and violet pigments that give such brilliant colors in leaves are due to the same pigments as the corresponding colors in flowers and fruits and the colors that develop in the autumnal coloration of the foliage of our deciduous trees.

The gayest colorations and most fantastic patterns in the foliage of ornamental plants are those where loss of green with various developments of yellow occur along with red and blue pigments. In these, a shade of red in yellow areas produces an effect quite different from that when it is in green areas. This is well illustrated in the crotons with their fantastic combinations of green, yellow, and various shades of red, with also marked variations according to the age of the leaves. A large and extremely varied collection of these plants may be seen in the main greenhouses near the entrance from the Third Avenue elevated railway. (A group of these plants was included in the collection of variegated plants assembled for display in connection with the lecture.)

In propagating plants with ornamental foliage, it is to be remembered that many of them do not breed true from seed. This is especially true of the green and white (or yellow) variegations, both blotched and white-bordered. It is also the case for many patterns of red coloration. These plants are very generally propagated vegetatively by such means as cuttings. In this way the numerous ornamentals, such as the white-bordered geraniums and pelargoniums and the red-blotched or solid-red types of Coleus, may be kept rather constant to type in garden or pot culture.

A. B. STOUT.

SPRING-FLOWERING BULBS AND HOW TO FORCE THEM FOR THE HOME[1]

More than four million dollars worth of spring-flowering bulbs are imported annually into the United States, chiefly from Holland, where climate and soil appear to be especially favorable for producing the best results. Promising beginnings in growing them for the home market have, however, already been made in our own country, particularly on the Pacific Coast.

For indoor forcing one should have first-size or "top size" bulbs, which are more certain to produce large handsome flowers, though for mass planting out of doors the second-size bulbs give very satisfactory results and they are much cheaper. October and November are the usual months for planting, but for early forcing, that is, to have flowers indoors by Christmas or in early winter, it is necessary to pot up most kinds of bulbs in August or early September. There are a few kinds, such as the Paper-White Narcissus and other varieties of the so-called *Narcissus polyanthus*, that may be started at almost any time and carried through to successful flowering in five or six weeks but this does not apply to other kinds of Narcissus such as daffodils, nor to tulips and hyacinths, which must have a longer time to develop a root-system and as a rule can not be successfully forced until three, four, or five months after planting.

The common Paper-White Narcissus, the so-called Chinese Lily, which is simply another variety of Narcissus, and various kinds of hyacinths are often grown in the house and fed only by water, though gravel or pebbles are commonly placed in the glass or earthen dish to assist the roots in anchoring the plant. But better results are obtained by growing the bulbs in a proper amount of fertile soil. A sandy loam is best and its fertility may be increased by mixing in well-rotted manure in a proportion as high as half and half. Chemical fertilizers are sometimes dangerous and should be used with caution and restraint, if at all. For ordinary purposes, a shallow earthen pot, known professionally as a "bulb pan," or a shallow box known as a "flat," is quite satisfactory as a container for the bulbs that are to be forced, but for producing exhibition flowers, a

[1] Abstract of a lecture given in the Central Display House of Conservatory Range 2, on Saturday afternoon, March 22, 1924.

deeper vessel, known as an azalea pot, is desirable. One of the great secrets of success is to have the fine roots well formed before active forcing is begun and these fine roots as a rule, with the possible exception of the Paper-White Narcissus and its near relatives, develop best when the pots are kept rather cool—just a few degrees above freezing. It is an excellent plan to plunge the potted bulbs in the garden, if one has a garden, bringing them into the house before the ground freezes heavily for the winter. The ideal series of temperatures for the successive stages of the forcing process for hardy bulbs runs about as follows: 40° F. for root-formation, 50° for the development of stems, leaves, and buds; 60° for the development of the best flowers; 70° for rapid forcing after flower-buds are well formed. Higher temperatures are occasionally used for rushing the development, but the resulting flowers are not so good and with some varieties there is danger that the buds will not open at all.

Of varieties especially adapted for forcing, Kathleen Parlow, pure white, is one of the best of the crocuses. Of the daffodils, the double yellow Von Sion is popular with the florists. Of higher grade is King Alfred, of the single and long-trumpet group. Similar to this but cheaper and somewhat smaller-flowered are Emperor and Empress, the latter with yellow trumpet and white perianth lobes.

Of the early tulips, La Reine is a favorite among the whites, Mon Tresor and Yellow Prince among the yellows, Pink Beauty among the pinks, and Vermillion Brilliant among the scarlets; Keizerkroon shows a striking combination of scarlet and gold. Among the stately later-flowering Darwin tulips, Pride of Haarlem, rich red or purple, Clara Butt, pink, and Mr. Farncombe Sanders, brilliant scarlet, shaded rose, are especially popular.

All of the varieties of hyacinths may be successfully flowered in the house, if one does not keep them too warm and if one is careful to get them well rooted before trying to force them into flower. Of the hyacinths, La Grandesse and L'Innocence are probably the best white varieties. Gertrude and Lady Derby are standard pinks; Yellow Hammer is a good yellow, and Grand Maitre and King of the Blues are excellent blues.

Freesias and varieties of the big handsome-flowered Amaryllis (or, more properly, Hippeastrum) are easy to grow in the home, but lilies and lilies of the valley are best managed in the glass

houses of the professional horticulturist. Our homes are usually altogether too warm for the successful forcing of the dainty snowdrop, the blue Siberian squill, and the attractive "glory of the snow." These hardy harbingers of spring seem to resent confinement; they are happiest when left out of doors where they may be buffeted by the winds of March and where they may see an occasional snowflake.

MARSHALL A. HOWE.

DESTRUCTIVE FUNGI[1]

The average person thinks of fungi, if indeed he ever thinks of them at all, as representing a small and obscure group of plants of questionable habits and which serve no useful purpose in the world except to furnish amusement for those who have nothing better to do, or to tickle the appetite of the mushroom lover. It may be that, owing to our lack of knowledge, the fungi did at one time occupy this unimportant place in the world of affairs, but this is no longer true. This once small group of plants which were studied only for pastime has now become a great world of living organisms represented by more than fifty thousand species, which number is daily increasing by the discovery of new ones.

But what good are they?—is the question with which the mycologist (as the student of fungi is called) is most frequently confronted. To answer this question would require more time than we have at our disposal. Overlooking their importance as articles of food, and overlooking the fact that many vast industries are based upon the growth and activities of these often minute organisms, we will concern ourselves only with the negative phases of the subject, *i. e.*, their destructiveness and especially their relation to the diseases of the higher plants. As an agency of disease the fungi occupy about the same relation in the plant world which the bacteria hold in the animal realm, in fact the bacteria and fungi have much in common.

The study of fungi has given rise to the science of plant pathology in which America today leads the world. This is attracting more attention and offering greater opportunity to

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden, on Saturday afternoon, April 19, 1924.

the young botanist than probably any other phase of botanical work. And well it may, for a single plant disease such as the "wheat rust" or the "chestnut blight" may cause many millions of dollars loss in a year or in a few years at most. When we recall that nearly every plant has its fungus disease and some have many, we can see the necessity for careful research, for until we know the cause of the disease, a remedy cannot be worked out except by mere chance, as may happen in some cases.

One of the first prerequisites for successful work in the control of plant diseases is a thorough knowledge of the organisms which cause them, which means a knowledge of the fungi. One of the chief characteristics of the fungi is the fact that they are entirely devoid of green coloring matter present in the leaves of the higher plants. This absence of green color might seem to be of little importance unless we take into consideration the fact that plants possessing green color or *chlorophyll* are able to live independently on simple materials found in nature, while those lacking green color must depend upon organic matter living or dead. When fungi come to depend upon living plants for their food they become parasites and are usually injurious to their hosts.

In structure the fungi consist of a growth of very delicate threads which are massed together so as to give rise to the structures which we recognize as mushrooms, mildews, or molds. They are reproduced by means of minute bodies known as spores. These are so small that they are blown about by the wind. They are so abundant that we breathe and eat them and usually they do no harm. In a few cases they may give rise to diseases of the human body such as ringworm of the scalp and nails or mycosis of the ear.

About seventy lantern slides were used to illustrate the characteristics of the fungi and their relation to diseases of plants. Great stress was laid upon the recently introduced white-pine blister rust and the methods used to prevent its spread. Unlike the chestnut-blight fungus, which has a very simple life history, the white-pine blister rust has a complex cycle, and is known to the botanist as a heteroecious parasite. By this we mean that it has distinct stages which are unlike in appearance and live on entirely different and unrelated hosts. The hosts concerned in this case are the five-leaved pines on

the one hand and the gooseberries and currants belonging to the genus *Ribes* on the other. The blister rust cannot spread from one pine to another but must go from the pine to the currant and from there back to the pine. If we destroy the currants and gooseberries, we "break down the bridge" by means of which this destructive fungus spreads.

Since the white pine is among our most valuable lumber trees, it is quite important that this disease should be checked and the Government is attempting to do this through the destruction of the wild *Ribes* through which it spreads. It is also very important that this fungus should not be introduced into our western white pines, which are also exceedingly valuable and are known to be susceptible to the disease. In order to accomplish this result a quarantine has been established forbidding the shipment of *Ribes* or five-leaved pines from infected to uninfected areas. In infected areas, while the spread of the disease may be checked, it is doubtful if it can ever be eradicated now that it has become established.

Both the chestnut blight and the white-pine blister rust stand out as striking examples of the danger of unrestricted importation of plants from foreign countries. If the Government officials should seem to be a little overbearing in the enforcement of these restrictions or if they should enter our back yards and destroy our currant bushes, we should not criticise them too severely but just smile and "remember the chestnut."

FRED J. SEAVER.

THE 1924 DAHLIA COLLECTION

The collection of living dahlias for 1924 is somewhat larger than in previous years. One of the beds, sometimes referred to as the "Marean bed," has been extended at both ends and a small new bed to the north of it has been added. In both of these the plantings have been made with some regard to color effects, with a considerable number of a kind of several of the freer-flowering varieties. In the smaller of these beds, designed to produce a mass effect of red or scarlet, the varieties selected are Scarlet Bedder, Breeze Lawn, Standard Bearer, Giant Ruby, and Souvenir de Gustave Doazon. In the larger, the colors range from shades of orange, gold, or bronze at one end to shades

of rose, salmon-pink, and lavender-pink at the other end. The chief varieties used here are Sagamore, Captain John, Sherlock, The U. S. A., Myra Valentine, Red Cross, Mrs. Wm. J. Rowe, Jean Chazot, Francis Lobdell, Countess of Lonsdale, Jersey's Beauty, Jersey's Jewel, Virginia Harsh, Mariposa, Jersey's Rose, George Walters, Mrs. Josiah T. Marean, Mrs. I. de Ver Warner, Siskiyou, and Esther R. Holmes.

In the two main borders, one north of the railway station plaza and the other south, the arrangement has been chiefly by classes, as in previous years, with little regard to color. In the north border are found representatives of the Duplex, Peony-flowered, Hybrid Cactus, Cactus, and Decorative groups. In the south border are the Singles, Collarettes, Shows, Hybrid Shows, Pompons, and some of the Decoratives. Commercial and amateur growers of dahlias have been generous in supplying roots and green plants, as in the previous six years of the border's existence. Prominent among the contributors to the 1924 collection are W. H. Waite, Rumson, N. J.; J. J. Broomall, Eagle Rock, California; Meachen & Sherman, Stratford, Conn.; Fisher & Masson, Trenton, N. J.; Dahliadel Nurseries, Vineland, N. J.; Babylon Dahlia Garden, Babylon, N. Y.; Huntington Dahlia Gardens, Huntington, N. Y.; William F. Jost, East Haven, Conn.; Slocombe's Dahlia Gardens, New Haven, Conn.; A. E. Doty, New Haven, Conn.; C. Louis Alling, West Haven, Conn.; R. C. Colt, Garrison, N. Y.; Flushing Dahlia Gardens, Flushing, N. Y.; Mrs. Charles H. Stout, Short Hills, N. J.; W. Atlee Burpee Co., Philadelphia, Pa.; Dr. F. R. Waite, Jr., Upper Montclair, N. J.; Nat-Wal Dahlia Garden, Verona, N. J.; Reinhold Greinberg, Wayne, Pa.; Mills & Co., Mamaroneck, N. Y.; N. Harold Cottam, Wappingers Falls, N. Y.; Frederick Dahlia Garden, Frederick, Maryland; Richard Vincent, Jr., & Sons, White Marsh, Maryland; Geo. L. Stillman, Westerly, R. I.; Geo. W. Fraser, Willimantic, Conn.; F. P. Quinby, White Plains, N. Y.; Chas. H. Totty Co., Madison, N. J.; Myron E. Douglas, Woodbury, N. J.; and J. A. Kemp, Little Silver, N. J.

The plantings, except for the inevitable replacements, were made during the first week of June. The copious rains of April and May had left the soil in good condition and an average rainfall in June gave the young plants a favorable start. July was dry, necessitating some use of the hose. Leaf hoppers and red

spiders, the two chief enemies of the dahlia, have not been troublesome up to the date of writing (August 12), but stem-borers, as last year, were destructive, especially in the back rows of the main border immediately adjacent to the shrubbery.

An investigation of much interest to dahlia-growers is being undertaken this year by Dr. A. B. Stout, Director of the Laboratories, who will try to determine the facts as to sterility and fertility of the seeds in certain selected varieties representing the principal groups of dahlias. He will, in particular, lay the foundations for ascertaining another season the extent to which cross-pollination may be necessary for the setting of fertile seed.

Without counting somewhat more than 100 plants that are scattered in the miscellaneous flower-beds, and others being used in the experiments by Dr. Stout, the dahlia collection this year includes 992 plants, representing 462 varieties, of which many are promising novelties. Some of them have been allowed to bloom early, beginning in the latter part of July. The present condition of the border indicates an unusually good display of flowers in September and October.

MARSHALL A. HOWE.

PUBLIC LECTURES DURING SEPTEMBER

Free illustrated public lectures will be delivered in the Museum Building at four o'clock on Saturday afternoons during September, as follows:

Sept. 6. "Some Floral Products of the Plant Industries."
Mr. K. R. Boynton.

Sept. 13. "American Botanists of the Past."
Dr. J. H. Barnhart.

Sept. 20. "Shade Trees, the Companions of Man."
Mr. Carl Bannwart.

Sept. 27. "Dahlias and their Culture." Dr. M. A. Howe.

NOTES, NEWS, AND COMMENT

Dr. N. M. Grier, Professor of Biology in Washington and Jefferson College, visited the Garden on July 31, with a class of fourteen students from the Biological Laboratory at Cold Spring Harbor.

Dr. John T. Buchholz, Professor of Botany in the State University of Arkansas, spent a part of July and August at Cold Spring Harbor and The New York Botanical Garden in connection with his work on pollination and plant breeding.

Mr. David D. Keck, a senior in Pomona College, California, spent the months of July and August at The New York Botanical Garden as a holder of a Garden scholarship. He assisted Dr. Stout in experimental studies of sterilities in *Lilium* and *Hemerocallis*.

Mr. Rafael Menendez Ramos, Director of the Agricultural Experiment Station at Rio Piedras, Porto Rico, recently spent a day at the Garden. He is especially concerned with the mosaic disease of sugar cane, which is doing an increasing amount of damage in the sugar-growing sections of the West Indies.

Mr. Bertrand H. Farr, proprietor of the Wyomissing Nurseries Company, Wyomissing, Pennsylvania, made a visit to the Garden recently to inspect the numerous new types of *Hemerocallis* that have appeared among the hybrid seedlings of the experimental plots.

Mr. Ernst J. Schreiner, from the New York State College of Forestry (Syracuse University), has been secured by the Oxford Paper Company for investigations with *Populus* in which The New York Botanical Garden is coöperating. Mr. Schreiner is making the Garden his headquarters for this work.

Professor F. D. Kern of Pennsylvania State College and Professor H. H. Whetzel have recently returned from Porto Rico with an extensive collection of fungi for critical examination. They have been making a special study of the rusts of the island for the Botany of Porto Rico, which is being published by the New York Academy of Sciences.

The meetings of the British Association for the Advancement of Science which were held in Toronto, Canada, August 1–33, had a total enrolled attendance of more than 2500, of which number nearly 600 came from "over seas." The New York Botanical Garden was represented at the meetings by Professor Frederic S. Lee, President of the Board of Managers; Professor R. A. Harper, Chairman of the Scientific Directors; Professor H. M. Richards, of the Scientific Directors; and Dr. Marshall A. Howe, Assistant Director.

Dr. A. B. Stout, Director of the Laboratories, spent two weeks during July and August at Presque Isle, Maine, continuing studies on sterilities of potatoes in coöperation with the U. S. Department of Agriculture. A paper by Dr. Stout and Mr. C. F. Clark of the Bureau of Plant Industry on "Sterilities of Wild and Cultivated Potatoes with reference to Breeding from Seed" has recently been published by the U. S. Department of Agriculture as Department Bulletin No. 1195, which has been issued also as Contributions from The New York Botanical Garden, No. 256.

Dr. John K. Small, Head Curator of the Museums, returned on July 30 after a three weeks' visit to Florida mainly in search of irises (with special reference to finding the fruits), papaws (*Asimina*), and plants of other critical genera and species. He explored particularly the eastern part of northern Florida, the Apalachicola River region, the Gulf Coast region from Apalachicola to Fort Myers, the northern end of the lake region, and the eastern coast from Cape Sable to the Saint Mary's River. The search for the plants involved required an itinerary of over three thousand miles in the State. The garden collections were enriched by many specimens —living, in fluid, and dried.

Meteorology for July. The total precipitation for the month was 1.77 inches, more than three-fourths of which fell on the last afternoon of the month. The maximum temperatures recorded for each week were 81.5° on the 6th, 89° on the 9th, 90.5° on the 16th, 94.5° on the 24th and *97.5° on the 30th.* The minimum temperatures were 56° on the 3rd, *49° on the 12th,* 54° on the 19th and 56° on the 26th.

ACCESSIONS

Plant and Seed Accessions

42 *Dahlia* roots, 25 varieties. (By exchange with Dr. Marshall A. Howe.)

24 *Dahlia* plants, 10 varieties. (Given by Mr. R. C. Colt.)

24 *Dahlia* roots, 6 varieties, and 4 *Dahlia* plants, 4 varieties. (Given by Mr Wm. F. Jost.)

21 *Dahlia* roots, 9 varieties. (Given by Slocombe's Dahlia Gardens.)

16 *Dahlia* roots, 8 varieties, and 2 *Dahlia* plants, 6 varieties. (Given by Dahliadel Nurseries.)

16 *Dahlia* plants, 8 varieties, and 5 *Dahlia* roots, 2 varieties. (Given by Meachen & Sherman.)

17 *Dahlia* plants, 10 varieties. (By exchange with Nat-Wal Dahlia Gardens.)

15 *Dahlia* plants, 10 varieties. (Given by Mr. W. H. Waite.)

12 *Dahlia* plants, 6 varieties, and 4 *Dahlia* roots, 2 varieties. (Given by Huntington Dahlia Gardens.)

12 *Dahlia* roots, 7 varieties. (Given by Mr. A. E. Doty.)

11 *Dahlia* roots, 8 varieties, and 2 *Dahlia* plants, 1 variety. (Given by Babylon Dahlia Gardens.)

11 *Dahlia* roots, 11 varieties. (By exchange with Dr. F. R. Waite, Jr.)

10 *Dahlia* plants, 5 varieties. (Given by Richard Vincent, Jr., & Sons.)

10 *Dahlia* roots, 5 varieties. (Given by W. Atlee Burpee Co.)

9 *Dahlia* roots, 9 varieties. (Given by Mr. Schuyler M. Hyatt.)

8 *Dahlia* plants, 8 varieties. (Given by Fisher & Masson.)

8 *Dahlia* roots, 8 varieties. (By exchange with Dr. John K. Small.)

7 *Dahlia* roots, 5 varieties. (By exchange with Frederick Dahlia Gardens.)

7 *Dahlia* roots, 4 varieties. (By exchange with the New Jersey Agricultural Experiment Station.)

7 *Dahlia* roots, 3 varieties. (Given by Mr. C. Louis Alling.)

5 *Dahlia* clumps, 4 varieties. (By exchange with Dr. Romeo Roberto.)

5 *Dahlia* plants, 5 varieties. (Given by Prof. George W. Fraser.)

5 *Dahlia* roots, 5 varieties. (By exchange with Mr. A. Hentschel.)

5 *Dahlia* roots, 3 varieties. (Given by Flushing Dahlia Gardens.)

4 *Dahlia* plants, 1 variety. (By exchange with Mr. John McCarroll.)

4 *Dahlia* roots, 4 varieties. (By exchange with Mr. Myron E. Douglas.)

4 *Dahlia* roots, 4 varieties. (By exchange with Miss Rosalie Weikert.)

4 *Dahlia* roots, 3 varieties. (By exchange with Mrs. Chas. H. Stout.)

3 *Dahlia* plants, 3 varieties, and 2 *Dahlia* roots, 2 varieties. (Given by Mr. J. J. Broomall.)

3 *Dahlia* plants, 2 varieties, and 2 *Dahlia* roots, 2 varieties. (By exchange with Mr. F. P. Quinby.)

2 *Dahlia* plants, 1 variety. (Given by Charles H. Totty Co.)

2 *Dahlia* roots, 2 varieties. (By exchange with Mr. C. P. Brunner.)

2 *Dahlia* roots, 2 varieties. (Given by Mr. Geo. L. Stillman.)

2 *Dahlia* roots, 1 variety. (By exchange with Mr. A. Lowenfels.)

2 *Dahlia* roots, 1 variety. (By exchange with Dr. Edwin Marquand.)

2 *Dahlia* plants, 2 varieties. (Given by Mr. Wm. Marshall.)

1 *Dahlia* plant and 2 *Dahlia* roots, 2 varieties. (By exchange with Mr. L. B. Hulit.)

1 *Dahlia* root. (Given by Mr. J. A. Kemp.)

1 *Dahlia* plant. (Given by Mr. Wm. B. Sweeney.)

1 *Dahlia* root and 1 clump of *Dahlia* roots. (By exchange with Mrs. B. W. Moore.)

4 plants for Iris Garden. (Given by Mrs. A. Fellows.)

65 plants for Iris Garden. (Given by Bertrand H. Farr.)

6 plants for Iris Garden. (Given by Mrs. J. F. Emigholz.)

134 plants for Iris Garden. (Given by The Glen Road Iris Garden.)

47 plants for Iris Garden. (Given by Mr. John C. Wister)

PUBLICATIONS OF

The New York Botanical Garden

Journal of The New York Botanical Garden, monthly, containing notes, news, and non-technical articles. Free to members of the Garden. To others, 10 cents a copy; $1.00 a year. Now in its twenty-fifth volume.

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Memoirs of The New York Botanical Garden. Price to members of the Garden, $1.50 per volume. To others, $3.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. viii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of the New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the eleventh volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A **museum**, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An **herbarium**, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 34,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ————

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

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JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

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PUBLIC LECTURES DURING OCTOBER

NOTES, NEWS, AND COMMENT

ACCESSIONS

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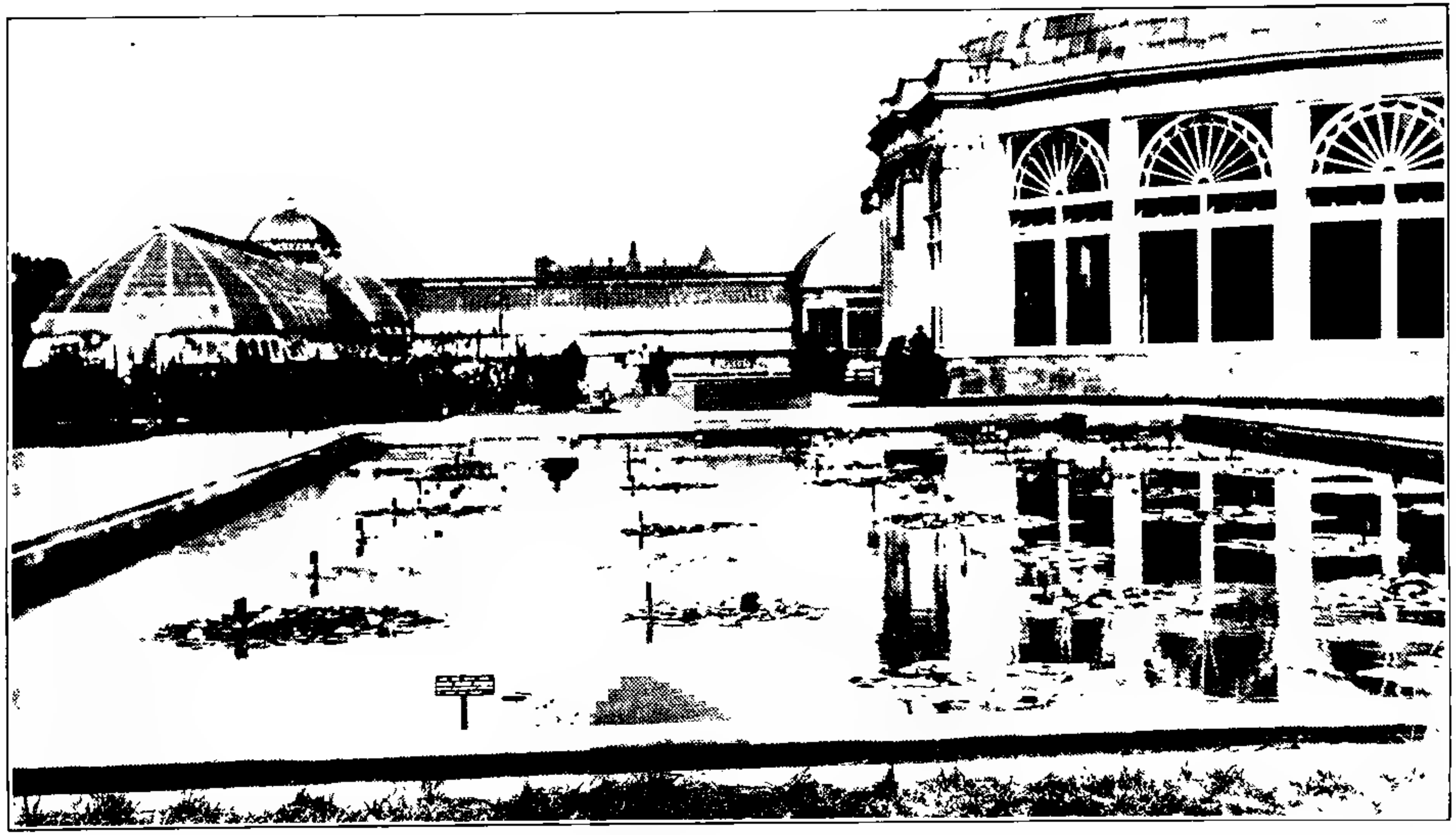

THE HARDY-WATERLILY POOL AUGUST 1924

JOURNAL

OF

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WHENCE CAME OUR ORCHIDS?

Some Aspects of the Why and Wherefore

It is apparently impossible to tell, correctly at least, the conditions under which even the immediate ancestors of our modern orchids developed or existed. However, from what evidence we have, we may assume that they were disseminated, both terrestrial and epiphytic kinds, from tropical regions where conditions were conducive to their growth. Conditions may have changed from time to time with the vacillating climate and physiography, and some kinds may even have become amphibious. Such a state is not improbable, for we find amphibious orchids in the southeastern United States today—a true *Habenaria*, *H. repens*, a *Habenaria* relative, *Habenella Garberi*, and an adder's-mouth, *Malaxis floridana*, may be mentioned. If the conditions became more unfavorable to the growth of the terrestrials, which we will assume were the primitive orchids—for the remotest ancestors, which were doubtless very primitive, may have existed before trees developed in the vegetable kingdom—some kinds may later have betaken themselves to trees after these forms of vegetation came on the scene, and gradually developed epiphytic habits. Now, this transition from a terrestrial to an epiphytic habitat is not as unlikely as it might seem, for in the tidal swamps of the Cape Sable region of Florida, where the water gets too high twice a day to permit terrestrial plants to function properly, terrestrial cacti, highly specialized plants,—species of Opuntia, Harrisia, Acanthocereus—betake themselves to the trees, and there lead an epiphytic existence. Moreover, a goodly number of the epiphytic orchids are perfectly at home in the mangrove trees in the same tidal swamps.

If we assume that the orchids were scattered into temperate latitudes, and even north of the arctic circle, from great tropical reservoirs, we can imagine that the present-day orchids of Florida are the descendants from seeds originally brought in by the winds or by birds, from tropical America. The epiphytic species of Florida, almost without exception, also occur naturally in the West Indies or in continental tropical America, or in both. Hurricanes, and even trade-winds—especially when the lands were more extensive and the separating waters less extensive—and migratory birds from the West Indian forests and even from the South American jungles, could easily have transplanted the dust-like orchid seeds to the hammocks of primeval Florida.

Now, Florida at no remote time, geologically speaking, was much larger in area and higher in altitude than it is at present. If this primeval Florida was wholly or in greater part hammock-clad, as evidence seems to indicate, its orchid flora was, perhaps, much larger than it is now. The Florida of the very recent geologic era, essentially of its present size, except for a slight, so to speak, reduction as a result of various kinds of erosion and a supposed gradual sinking of the whole land, was evidently a vast hammock.

It is safe to assume that formerly epiphytic orchids were abundant. Natural agencies which existed before man's advent and were exaggerated after his coming, have reduced the hammocks to a mere fraction of the primeval broad-leaved forest. No doubt the epiphytic orchid flora also shrank, both in numbers and in kinds. This seems to be evidenced by the scattered, even a spotted, distribution of many of the species. The shrinking of the forest with its epiphytes is still under way and may be observed in Florida today.

Epiphytic orchids to the number of twenty-five now grow naturally in the remnants of the hammocks of floristically tropical Florida. There are two categories besides the epiphytics also present—the other extreme, terrestrial orchids (fifty species) and an intermediate group, humus orchids (nine species).

Whichever class was the primitive type, one must conceive that the other classes were derivatives, and that their origin was not so very remote, geologically speaking.

In this connection, the development and the functions of

certain organs in relation to their environment is of particular interest. There is, of course, the well-known highly specialized and adaptive flower of the orchid; but in addition to this the moisture-storage and food-storage apparatus of the orchid is also specialized and adaptive.

The epiphytes have long, usually numerous, cord-like roots—a binding apparatus as it were, or an anchor—developed partly in order securely to hold the plant to the bark of the host and partly to absorb nourishment. The caliber and length of the roots vary in different genera. Some species have specialized stems or branches, often well-developed storage-organs known as pseudobulbs. Those plants with pseudobulbs produce more slender roots than those without them. Thus gigantic tree orchids with well-developed pseudobulbs have quite slender roots, although often very many of them.

On the other hand, small epiphytes without pseudobulbs often have coarse roots. An extreme example exists in the case of the white butterfly-orchid (*Polyrhiza Lindeni*) which has practically no storage reservoirs other than the roots—neither pseudobulbs, nor leaves, nor scarcely any stem—but a relatively vast root-system that is wholly out of proportion to the rest of the plant. The coarse worm-like roots contain much chlorophyll and thus function as leaves as well as a binding apparatus.

The leafy and flowering stems of the epiphytic orchids are long-persistent—perennial as it were. Mineral matter in their habitat is scarce and, consequently, slow to be absorbed, even in limited quantities, into the tissues. The stem and persistent leaves are firm and leathery and contain and hold fast to an abundance of water and nourishment. They perform their life-cycle slowly. When removed from their natural habitat they will remain fresh for a considerable period, even when their outside supply of food and water is cut off. Of course, the epiphytes are humus plants in a limited sense. The bark to which they are attached is continually decaying and the entangled masses of dead but long-persistent roots collect a more or less abundance of dead leaves and twigs as they fall from the branches of the host above them.

Now, a step away from the epiphyte is the humus-lover. In these orchids we find the roots modified, of quite a different

character, and copiously infested with friendly fungi. They are more fleshy than those of the epiphytic kinds, frequently very thick and succulent, and even tuber-like. This mycorhiza—translated into English, fungus-root—and the consequent symbiosis are beneficial to the plants. The humus-lovers are also hammock-plants and their habitat does not require much in the way of stored nutriment in the root-system. A rather constant humid atmosphere and capillary water keep them quite evenly supplied with moisture. Whatever reserve nourishment and moisture they need is stored in the roots. The life cycles of their flowering stems and leaves is rapid and short. The water storage is transient, mineral matter is somewhat more available than in the case of the epiphytes, and consequently the "plants" are annual in duration. When removed from their natural habitat, their moisture continues to be given off rapidly from acquired habit and the plants promptly wither.

An additional step away from the hammock-lovers brings us to the sand-lovers, or more broadly speaking, soil-lovers. In the typical ones we find great storage reservoirs closely associated with the root systems in the form of large succulent corm-like structures which are renewed periodically, often annually. In this case fibrous roots are few. The supply of atmospheric moisture and capillary water is much more uncertain in the sandy, airy pinelands than in the humid hammocks with their spongy humus floors. These subterranean reservoirs of food and moisture tide over the plant under temporary adverse conditions and enable it to perform its annual cycle even when rain fails and capillary water is scant.

The typical sand-lover combines some of the characters of both the epiphyte and humus-lover in its foliage. Like the latter its stem and leaves are annual, for its available supply of mineral matter is copious, and like the former they are more or less leathery and slow to transpire their moisture, for they needs must hold it in an atmosphere where moisture is liable to be scant and capillary water much reduced at times.

There are exceptions in this matter of distribution in habitats—irregulars, as it were, and just as interesting and instructive as the regulars. Superficially considered, they sometimes might be designated as deserters, but in the light of the past and present floristics of the region, better considered as merely laggards or

castaways. These are chiefly represented by close relatives of the humus-lovers. As the hammocks shrank or were wholly destroyed, a few kinds of orchids, evidently with a limited geographic distribution, were stranded in the areas then left bare of arboreous growth and later occupied by invading pine trees, now forming the present pinelands. Rather than succumb, so to speak, they adapted themselves at least temporarily to their new environment.

These typical hammock and humus plants have adapted themselves to growing in the open pinewoods in a sandy soil quite deficient in humus, comparatively speaking. Such plants as *Habenaria quinqueseta*, *Triphora Simpsonii*, *Carteria pinetorum*, *Stenorhynchus orchioides*, and *Ponthieva Brittonae* are to be found only in the pinelands, perhaps only where there is considerable humus in the sand, but still maintain the succulent roots and soft tissues of the humus-lovers, and habit of producing stems of annual or seasonal duration only. How long ago were they humus-lovers in their typical hammock habitat? Answer? Their behavior seems to indicate that they are not yet wholly adapted to their present habitat and environment. For, unlike their associates, the plants with specialized storage reservoirs, and which appear annually and flower and fruit, these castaways are to be found only at irregular intervals of several years, except perhaps, odd specimens in the case of larger colonies.

An instructive instance of a sudden, complete and quite recent change of habitat came to our attention during exploration in the floristics of Florida. We were surprised to find one of the butterfly-orchids (*Oncidium sphacelatum*) growing abundantly on the floor of a restricted area of pinelands. Now this orchid is a typical epiphyte with large pseudobulbs and long narrow leaves. Investigations indicated that the particular area where the orchid was growing had been, at no remote time, hammock-clad. This hammock was very likely destroyed by that arch enemy of the broad-leaved forest—fire—started naturally by lightning, or perhaps by Indians. The orchid survived and continued to grow on the hidden remnants of the hammock. So unusual was this habitat for a large epiphytic orchid that an investigation of the soil was undertaken. In the first place, the locality, in the pinewoods, was unusual on

account of the absence of saw-palmetto. The absence of this palm where it should normally grow is often an indication of formerly cleared land, but the floristics of this area of pineland did not suggest such a history. Conditions just beneath the surface, however, gave us rather conclusive evidence of a previous and different kind of forest covering and the reason for the occurrence of the orchid in question on the ground. Wherever the orchid grew were the remains—trunks in the last stages of decay—of the trees which fell during the destruction of the hammock, perhaps several centuries ago, just beneath the surface of the sand. When all the remains of the one time hammock shall have vanished, this orchid, unless it can adapt itself to an environment totally different from that to which its ancestors were accustomed, will disappear from the area in question.

This is but one instance of a prehistoric tragedy. Similar tragedies occur continuously in Florida, and thus the hammock area shrinks and along with it the epiphytic orchid flora becomes less and less extensive and less varied.

JOHN K. SMALL.

HARNESSING THE SUN: CAN BOTANISTS SOLVE THE MOTOR-FUEL PROBLEM?[1]

The ancients had some idea of their dependence on the sun, for they worshipped him; in our irreverent days we treat the sun much as a cart horse, that is, more or less indirectly we harness him up and make him do the world's work.

The world needs matter and energy. Although these two are interdependent, the latter is the one which is in danger of being depleted, because we are constantly degrading energy into less available forms, especially heat. For instance, when coal is used in a locomotive we change potential energy into kinetic energy, most of which is frittered away as heat.

The various sources of energy: Although we are to-day largely dependent on coal and petroleum, we may enumerate first the

[1] Abstract of lecture by Dr. M. A. Chrysler, Professor of Botany in Rutgers University, delivered in the Museum Building of The New York Botanical Garden on the afternoon of July 27, 1924.

natural sources provided by the wind, tides, and waterfalls. It will be seen that the energy is in each of these cases derived from the sun. When we put a waterfall in leash we are really harnessing the sun. The energy used in the human body is derived from plants, which in turn absorb it from the sun in the wonderful process of photosynthesis—the process of building up carbohydrates from carbon dioxide and water by green plants as a result of the energy absorbed from the sun by chlorophyll. Throughout the ages since chlorophyll made its appearance this has been the chief means by which the earth has absorbed solar energy for present and for future needs. It has been established that coal is the modified remains of the forests of the coal period, so that coal is fossil solar energy. It is only a hundred years since we began seriously to exploit these stores, but the supply is strictly limited, though vast. Much more limited and disappearing much more rapidly is our supply of petroleum, which like coal is undoubtedly a product of plant life. We are using up the principal of our legacy of oil at an alarming rate. Although gas now costs less than it did a few years ago, this is due to production beyond the power of storage. In thirteen years the supply of oil will be exhausted, and yet the demand grows apace.

Various ways of solving the problem have been offered: importing crude oil, "cracking" the oil, utilizing oil shales, using substitutes such as benzole and alcohol. The botanist has seriously considered the last proposal. Alcohol is generally made from grain, and it has been calculated that the present acreage of corn would if turned into alcohol generate as much power as the gasoline now consumed annually. But this grain crop represents sixty per cent of all the starch- and sugar-producing plants. Can we afford to burn up so much food-stuff? There are other possible sources of alcohol, such as sawdust, and perhaps we can improve on nature's wasteful method of absorbing solar energy. It may become necessary to devote ourselves largely to the growing of plants which mature quickly. We may also make greater use of the tremendous power of photosynthesis shown by the vegetation of the tropics. We may at any rate rest assured that when we have used up our stores of solar energy we will be dependent on our daily ration which we receive from that body. This threatens

a return to one-man power and a collapse of our civilization. Will our prodigality hasten this day, or will our inventive genius be equal to the task of more effectively harnessing the sun?

The lecture was illustrated by lantern slides, showing the various sources of energy and especially the rôle played by plants in absorbing solar energy. Plants were exhibited to illustrate the important part played by tropical vegetation in this process.

M. A. CHRYSLER.

BOTANIZING IN TRINIDAD[1]

Trinidad is the most southerly and largest of the islands known as the British West Indies and is separated from Venezuela only by the Gulf of Paria and the narrow channels of the Bocas. It was the privilege of the speaker to spend several weeks, February to April, 1921, on the island in connection with a survey of the plants of the region which is being conducted by The New York Botanical Garden. Leaving New York with the heaviest snow-storm of the season, the balmy weather which was encountered the second or third day out came as a welcome contrast to the frigid conditions which we had left behind.

The first land sighted after leaving New York was the island of Sombrero, the fifth day out. This was scarcely more than a ledge of rock protruding out of the water and barren of all signs of life except a lighthouse and its keepers. The evening of the same day we passed under the shelter of the island of Saba, a single volcanic cone, and although the island contains only about five square miles of land or rock it is populated by a Dutch colony of about twenty-five hundred people, who in spite of the tropical conditions have kept their fair complexions and light hair.

The first and only stop between New York and Trinidad was at Grenada, "the isle of spice," one of the most beautiful harbors to be found in the West Indies. As we stopped here only a few hours, no landing was made, although the black faces in boats of all descriptions literally swarmed around our ship begging us to allow them to take us ashore, each in his broken English

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, August 16, 1924.

trying to impress us with the superiority of his own particular craft.

The island of Trinidad is roughly rectangular in form and its dimensions are approximately 25 by 45 miles. The surface is level or undulating except in the northern and southern parts, where there are ranges of hills and mountains. The soil is fertile and agriculture is the chief industry, cocoa and sugar being the staple articles of commerce.

One of the chief natural objects of interest in Trinidad is the so-called "Pitch Lake" which is a lake in about the same sense that a glacier is a "river of ice." The area comprises over one hundred acres and is of unknown depth, soundings having been made to a depth of more than one hundred feet without reaching the bottom of the deposit. Although apparently hard, the substance is viscid and the surface soft and easily indented, especially in the middle of the day when warmed by the sun. The entire mass is in slow motion, so that holes dug in the center gradually fill in after a few hours or days at most. Although it has been the popular impression that the lake fills up from below as rapidly as the pitch is removed, this is not actually the case but the surface is gradually lowered as the substance is removed. The lake is not a new discovery but was seen by Columbus in 1498. This deposit is the chief source of asphalt used in the paving of our streets and probably will be for generations to come.

The first impressions of Port-of-Spain, the principal town of Trinidad, was of low buildings, narrow streets, and the rather sickening odor of fermenting cocoa beans. Later impressions were of beautiful parks and drives and the harsh but cheerful call of the kiskadee, a bird with habits similar to those of our king bird.

The plant-life, like the animal-life, of Trinidad is very different from that with which we are familiar in the north. One is surprised to see the blossoms of the cocoa trees coming out of the bark on the main trunk instead of the ends of the smaller branches. The cannon-ball, the calabash tree with its gourd-like fruits which are used as kitchen utensils, and the banyan tree with its many trunks, are alike objects of interest. The fungi or plant parasites are also characteristic and odd. Nearly a thousand collections of these interesting microscopic plants

were collected for study, some of which have already been described and published as new. This tropical island is not only an ideal place to visit but furnishes an unlimited field for scientific investigation.

FRED J. SEAVER.

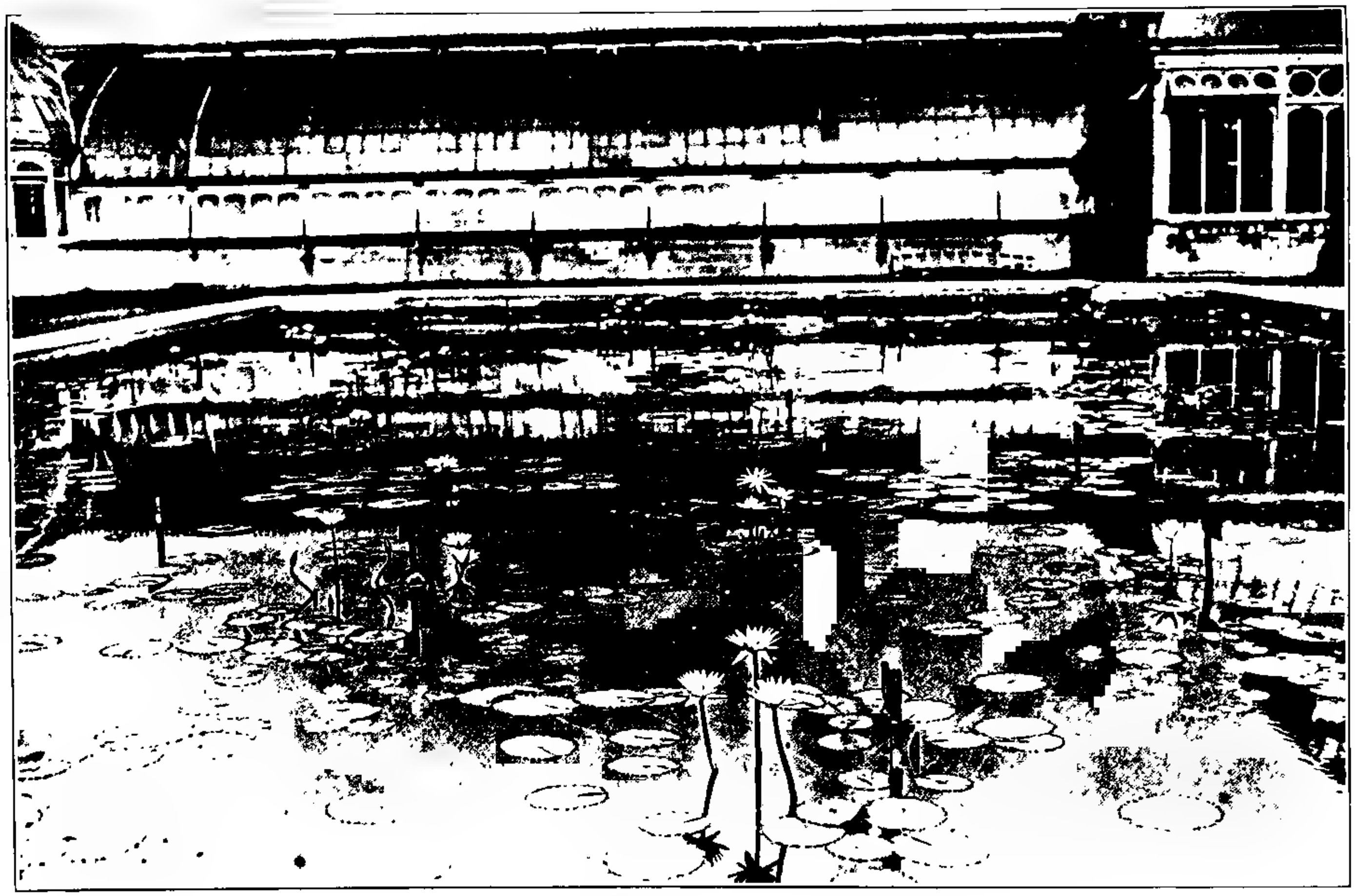
THE WATER-LILY POOLS

(WITH PLATES 298 AND 299)

After resurfacing, our tank for the hardy water-lilies was provided with 48 new concrete tubs. These are now newly planted, the result being as pictured in PLATE 298 They have bloomed very freely, the flowers were unusually large, and the plants entirely free from the pests and diseases often attacking them.

The hardy Castalias are of several diverse types, among which are a white, a yellow, a pink, and a red type, all with large flowers, and a type with small but many flowers, with color usually a mixture of red and yellow.

Our white varieties are *Castalia Marliacea albida*, the white Marliac hybrid; *tuberosa maxima*, a large fragrant flower, *alba candidissima*, *odorata* (our native pond-lily), and *Gladstoniana*, the largest pure white of all. Exceptionally fine yellow flowers were on *Marliacea chromatella* this year, and in *sulphurea grandiflora*. Tubs of these yellow forms are conspicuous, because we do not find this color among the tender lilies. The pink Castalias are represented in this tank by seven or eight sorts, the old Marliac variety *rosea* and some modern varieties, including Pink Opal, Rose Arey, and Wm. Doogue. One of the best pinks, large-flowered and fragrant, is Helen Fowler, named for the proprietress of the famous Shaw water-lily gardens near Washington. The dark red water-lilies were noticeably large and fine this year, especially Attraction, a French variety with purple-red petals; Escarboucle, vermillion, and James Brydon, a deep crimson, an American variety which this season excelled all others, especially in size. Then there is a whole series of lilies with small blooms but these in great quantities, their color being combinations of red and yellow; Sioux, *Seignoretii*, *Andreana*, and *grasiella* are of this type.



THE TENDER-WATERLILY POOL, AUGUST, 1924

This hardy-lily pool collection is to be augmented with several varieties of Nelumbo or lotus. The large specimens in the old tank have been divided and grown anew, and hence are very small this season.

The tender tropical Castalias are all started in greenhouses in submerged pots. They make a very rapid growth if the surrounding water is warm, *i.e.*, 75° to 80° F. They should not be put in out-door ponds until the latter part of May or early in June, when warm weather is assured. Blooming then follows soon if the weather is favorable. A box two feet square and one foot deep, filled with a mixture of two parts loam, three parts manure, one part leaf-mould and one part sand, is none too large for each plant. The flowers of tender lilies are produced on stout stalks and are as a rule held well out of the water. They are most desirable for cut flowers, lasting from three to five days. In some, the flowers close at night and open again the following morning; in others they open at night and close in the morning.

Among the day-blooming varieties, Panama-Pacific is a strong grower and free-flowering, the color a reddish-purple, with yellow stamens. In this, young plants spring from the upper surface of the leaves, as in the varieties *Daubeniana* and Mrs. Woodrow Wilson. *Zanzibariensis* is a deep purple and *zanzibariensis rosea* a rose pink; both seem to have been known in King Tut's time. The variety Wm. Becker is an improvement on the variety Wm. Stone.

Conspicuous among the night-blooming water-lilies are Frank Trelease, with mahogany-red flowers and bronze-red leaves; *dentata magnifica*, with cup-shaped broad-petaled white flowers and yellow stamens; Geo. Huster, with crimson flowers and bronzy leaves; and *Bissetii*, with beautiful rose-pink flowers.

K. R. Boynton and H. W. Becker.

FRUITING OF THE MAIDENHAIR-FERN TREE

Last year for the first time the maidenhair-fern tree (*Ginkgo biloba*) bore fruit in the Garden. Three of the larger trees of the fine collection presented by Siebrecht and Son in 1906 bore flowers, after being planted out eighteen years, the one fruiting specimen, by chance, being flanked on either side by

a staminate tree. The fruiting tree measured, last November, very nearly thirty-three inches in circumference, one foot above the ground, and it has increased very little in size in the ten months since then. Slightly over one hundred fruits developed last year and nearly all ripened and fell between the eleventh and seventeenth of November. The fruits are nearly globose, mostly slightly over one inch in diameter and enclose thick, nut-like seeds some thirteen-sixteenths of an inch long. The seeds have a very thin, brittle shell with the faintest of ridges encircling them about equally distant from either end and it is mostly along this ridge that the seed splits open the most readily into two parts, disclosing another peculiarity. There are some thin membranes covering the cotyledon that separate all around just under the ridge of the shell, the membranes on one side remaining attached to the cotyledon, on the other side adhering to the inside of the shell and causing the two parts of the shell to appear of different colors on the inside. The nuts are eaten by the Chinese, and, considering the disagreeable nature of the outer part, are not at all bad flavored.

This year the same three trees have flowered and the fruiting tree evidently will bear a much larger crop than it did last season. The mature fruits are mostly single on the slender pedicels but occasionally two develop to about normal size, or more commonly one will be much smaller than the other, when growing from the same pedicel.

R. S. WILLIAMS.

WILD-FLOWER PRESERVATION PUBLICITY

Some paper bags have been issued and sent to us for distribution, with the following appeal: PROTECT THE FORESTS FROM FIRE! AND CONSERVE NATURAL RESOURCES. Extinguish Matches, Cigars, Cigarettes—Put out your camp fire before you leave—Respect private property—Bury garbage—Avoid litter. KEEP GOD'S COUNTRY CLEAN AND SAFE.—The New York State Forestry Association, Albany, N. Y. An advertisement by a corporation of Utica, N. Y., enables the State Forestry Association to issue the bags at a very reasonable price—$1.00 per 1000. The bags have been found most useful, not only for picnics

and collecting, but for carrying library books in wet weather and various other purposes.

A neat paper napkin received from the Conservation Committee of the Garden Club of America reads:—"How many Wild Flowers shall we have Next Year? IT DEPENDS ON US. Keep the flowers growing; they'll do their own sowing."

E. G. BRITTON.

MEETING OF NORTHERN NUT-GROWERS' ASSOCIATION

The fifteenth annual convention of the Northern Nut-growers' Association was held at The New York Botanical Garden on September 3 and 4, under the presidency of Mr. Harry R. Weber of Cincinnati, with Dr. W. C. Deming of Hartford as secretary. About fifty persons were in attendance. This Association was organized at a meeting held in the Museum Building of the Garden in 1910.

The program of the recent meeting included numerous papers of scientific and economic interest. Among them were the following:

"Grafting the Hickories," by Dr. W. C. Deming.

"Notes on Mediate and Immediate Grafting in different Months of the Year, including a Report on Experiments with Grafting of Herbaceous Growths during the Growing Season," by Dr. Robert T. Morris.

"Developing a Nut Industry," by Dr. G. A. Zimmerman.

"Handling of Seeds and Nuts for Planting," by Mr. J. F. Jones.

"Hardiness in Nut Trees," by Mr. C. A. Reed.

"Stocks for Grafting the Hickory," by Mr. Willard G. Bixby

"The Watch for Blight-resisting Chestnut Trees," and "Protection of Wounds on Trees," by Prof. J. Franklin Collins.

"Nut Situation in Iowa," by Mr. S. W. Snyder.

"Heredity," by Dr. A. F. Blakeslee.

"Nut Tree Crops as a Part of Permanent Agriculture without Plowing," by Prof. J. Russell Smith.

"Transplanting Nut Trees," by Mr. Willard G. Bixby.

"Transplanting Nut Trees," by Mr. Henry Hicks.

"Nut-growing in Illinois," by Prof. Arthur S. Colby.

"Experiments in Nut-growing at Cornell," by Prof. L. H. MacDaniels.

"Nut-growing in Canada," by Prof. J. A. Nielson.

"Some Outstanding Insects of the Northern Nuts," by Dr. Fred E. Brooks.

"Promising Seedlings," by Mr. C. A. Reed.

On the afternoon of September 4, an excursion was made to the nurseries and orchards of Mr. Willard G. Bixby at Baldwin, Long Island, where many instructive experiments in nut-growing are being made. September 5, the third day of the meeting, was devoted to an expedition to Merribrooke, the estate of Dr. Robert T. Morris at Stamford, Conn., where demonstrations of different methods of grafting were made and where interesting and valuable collections of nut-trees were exhibited. On the 3rd and the 4th, the members of the convention were guests of the Garden for luncheon at Sormani's Restaurant.

THE CHESTNUT BLIGHT

Bronx Park enjoys (?) the dubious distinction of being the place in which the destructive chestnut-tree blight was first detected just about twenty years ago. Its discovery is commonly credited to Mr. Hermann W. Merkel, Chief Forester and Constructor of the N. Y. Zoological Park, who noted its disastrous effects in the Zoological Park in 1904. In the number of the Journal of The New York Botanical Garden for June, 1906, Dr. W. A. Murrill described in a non-technical way the fungus that causes the trouble and in Torreya for September of that year he gave it its first botanical name. He referred to the existence of the disease at that time in New Jersey, Maryland, and Virginia, and probably also in Alabama and Georgia, so that it does not seem certain that the Greater New York region was the original focus of the infection, as has been so often assumed. The "Weekly Bulletin of Forest Research News" of August 25, issued by the U. S. Department of Argiculture, has the following statement in regard to this chestnut disease:

"The sharp tang of early autumn, snow flurries, and the smell of roasted chestnuts at the street corner—an association dear

to the heart of the city folk of the Northeastern States. But for the last few years there has been a difference, in the chestnuts. The vendors are still there with their smoky, fragrant charcoal stoves, but the chestnuts they purvey are likely to be not the native little fellows of toothsome memory, but the big, inferior-flavored 'Italian' variety. Many passers-by have noted the change with regret, but without knowing the explanation. Every forester knows the story only too well, says the United States Forest Service."

"In 1904, in Bronx Park, New York City, an outbreak of chestnut blight was discovered. No one has yet discovered a means of stopping the blight. Since that time it has spread through southern New England, New Jersey, Pennsylvania, Maryland, Virginia, the Carolinas, and so down into Georgia. It is now threatening with a deadly certainty all chestnut timber in the Southeast. The Appalachian Forest Experiment Station, maintained by the Forest Service at Asheville, N. C., has been studying the development of the blight through the Coast States."

"The chestnut blight is now found throughout the entire Southern Appalachian region," says a recent report from the station, "and is spreading much more rapidly than originally predicted by forest pathologists. Within the next ten years large amounts of chestnut will be killed by the blight. Owners of chestnut stumpage should therefore sell their timber as rapidly as suitable markets can be found for it."

PUBLIC LECTURES DURING OCTOBER

Free public lectures will be delivered in the lecture hall of the Museum Building at four o'clock on Saturday afternoons during October, as follows:

October 4.	"The Sun, the Wind, and the Gardener"	Mr. Norman Taylor.
October 11.	"Autumn Colors"	Dr. A. B. Stout.
October 18.	"Preparing the Garden for Winter"	Prof. H. Findlay.
October 25.	"Bees and Bee Culture"	Mr. G. C. Norton.

NOTES, NEWS, AND COMMENT

Mr. L. E. Wehmeyer of the University of Michigan spent a few days at the Garden early in September, looking over the herbarium specimens of the fungus family Valsaceae.

Dr. A. B. Stout, Director of the Laboratories, spent ten days early in September at the New York State Agricultural Experiment Station at Geneva, where he gave special attention to problems of sterility and fertility in pears.

Miss Anna E. Jenkins of the Bureau of Plant Industry at Washington recently devoted a day to the examination of the Garden's collections of Exoascales, an order of parasitic fungi of which she is making a special investigation.

Dr. Bruce Fink, Professor of Botany in Miami University, Oxford, Ohio, who has a half-year's leave of absence from his teaching duties, is spending a considerable part of that time at The New York Botanical Garden, examining the collection of lichens with a view to preparing a monograph of the United States representatives of that group of plants.

Dr. Adolph E. Waller, Assistant Professor of Botany at the Ohio State University, devoted a month in August and September to studying the collections in the Economic Museum of The New York Botanical Garden and in consulting the Garden library. He is now interested especially in the geography of tropical plants of economic importance, supplementing work on the crop centers of the United States.

Dr. Otto Stapf, for many years keeper of the Herbarium and Librarian of the Royal Botanic Gardens at Kew, and now editor of the well-known Curtis's Botanical Magazine, visited the Garden on September 4 and 5. He attended the meetings of the British Association for the Advancement of Science in Toronto early in August and afterwards devoted a month to traveling and visiting botanical institutions in the United States.

Dr. H. A. Gleason, of the Garden staff, returned to New York on August 31 after a four months' absence abroad, most of which time was devoted to comparing his collections of South American plants with types preserved in the herbarium of the Royal

Botanic Gardens at Kew, England. A shorter visit was made also to the Muséum d'Histoire Naturelle in Paris.

Dr. Hugo Glück, Professor of Taxonomic and Pharmaceutical Botany at Heidelberg, and widely known for his scholarly work on the biology and morphology of aquatic plants, has been in this country during August and September. He visited The New York Botanical Garden several times, and spent more than a week investigating the interesting flora of the ponds of eastern Long Island.

Mrs. Wheeler H. Peckham, of New Rochelle, N. Y., who is a member of the Advisory Council of The New York Botanical Garden and is the Director of the Ninth District of the Federated Garden Clubs of New York State, lectured at the Garden on the afternoon of August 3 on "Flowers for the Home Garden." She discussed the flowers that may be grown in the home garden in our latitude, beginning with the earliest-flowering bulbous plants of spring, such as snowdrops, crocuses, and scillas, followed by daffodils and tulips, spring-flowering shrubs, irises, roses, lilies, dahlias, and chrysanthemums in the order of their blooming. She spoke also of the coming exclusion of Narcissus from the United States by the Federal Horticultural Board and mentioned certain wild flowers that might be used to advantage in our gardens. Lantern-slides, many of them colored, illustrated the talk; some of the most beautiful showed flowers naturalized or growing as if wild. Mrs. Peckham helped to organize the successful Garden Club of New Rochelle and served as its president for several terms.

"Some Choice Flowering Trees and Shrubs" was the subject of an instructive and helpful lecture given by Mr. Arthur Herrington of Madison, N. J., at The New York Botanical Garden on July 20. Among the flowering trees so well adapted for American gardens he made a strong plea for a more general planting of the crab apples and the hawthorns, so varied, beautiful, and profuse in blooming. In their season there is nothing more spectacular than these crab apples and one does not have to wait for years for them to display their beauty, since they commence to flower even while young and small; one has to wait only a year or two after planting them. There are native species well

worth a place in garden planting such as *Malus coronaria* which has fragrant flowers and the double form of *Malus ioensis* wins admiration from all who see it in flower. The Asiatic crabs are amazing in their flowering season, especially worthy of mention being *M. floribunda*, *M. Halliana*, *M. theifera*, and *M. Sargenti*. Our native flowering Dogwood is known to everyone but few people know anything about an Asiatic dogwood that has real merit for garden planting. Its name is *Cornus Kousa*. It comes first into leaf and then into flower in marked contrast to our native species, which flowers on leafless branches. The fringe tree and the silver bell tree were cited as worthy of a prominent place in gardens. Among the smaller flowering shrubs the lecturer enumerated many of the choicest character, especially the fine hybrid forms of mock orange (*Philadelphus*) *Deutzia*, and *Weigela*, originated by Lemoine of Nancy, France, and the numerous additions to the shrub family by the discoveries made by E. H. Wilson in Japan, Korea, and China, quite a number of which have already shown a ready adaptability to American climate and conditions. Many beautiful slides in color were shown, which enabled the audience to appreciate and visualize the charms of these choice subjects of which the lecturer was advocating more extended planting.

Mr. Gunther K. Ackerman, who had been in the employ of The New York Botanical Garden since 1917 as a custodian, died at his home in The Bronx on Sunday, July 27th, 1924. He was in his seventy-ninth year. Previous to his association with the Garden he had been Chief Clerk of the Park Department of the Borough of The Bronx for a period of about twenty-two years, and he was earlier Secretary of the New York City Civil Service Commission. This long experience in public office made him familiar with many of the details of city government and he had a broad acquaintance with city officials. As a younger man he was business manager of the old New York Star and was thus trained in newspaper work. He has recently, for a series of years, been Secretary of the Bronx Society of Arts, Science and History. He was faithful and diligent in all his duties and fertile in advice and suggestion. We deeply mourn his loss, and tender sympathy to his bereaved family.

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PLANTS AND SEEDS

34 plants for Iris Garden. (Given by Mr. Lee R. Bonnewitz.)

44 plants for Nurseries and Rock Garden. (Given by Mrs. W. H. Peckham.)

54 plants for Wild Rose Garden. (Given by Bobbink & Atkins.)

40 plants for Arboretum and Conservatories. (By exchange with U. S. Dept. Agric.)

36 plants for Conservatories and Iris Garden. (By exchange with Mr. C. H. Connors.)

29 plants for Rock Garden. (By exchange with Mr. Clarence Lown.)

16 plants for Conservatories. (By exchange with U. S. Nat. Museum through Dr. J. N. Rose.)

3 plants for Iris Garden. (Given by Mr. Chas. L. Gowe.)

2 plants for Iris Garden. (Given by Mrs. R. M. Davis.)

5 plants for Conservatories. (Given by Mr. G. A. Lowry.)

5 plants for Iris Garden. (Given by Mr. J. X. Schreimer.)

1 plant for Iris Garden. (Given by Mrs. C. E. Byrem.)

2 plants for Iris Garden. (Given by Mr. E. O. James.)

6 plants for Iris Garden. (Given by Mrs. C. B. Peck.)

8 plants for Iris Garden. (Given by Mrs. M. W. Jacobs.)

7 plants for Iris Garden. (Given by Mr. C. H. Hall.)

5 plants for Iris Garden. (Given by Mr. D. W. C. Ruff.)

14 plants for Nurseries. (Given by Mrs. J. E. Collier.)

5 plants for Iris Garden. (Given by Mr. H. C. Groehl.)

5 plants for Iris Garden. (Given by Mr. H. F. du Pont.)

24 plants for Iris Garden. (Given by Mr. A. E. Wohlert.)

14 plants for Iris Garden. (Given by Mrs. Wm. Carter.)

4 plants for Iris Garden. (Given by Mrs. E. M. Aldrich.)

2 plants for Iris Garden. (Given by Miss Esther P. Foster.)
4 plants for Iris Garden. (Given by Miss F. E. McIlvaine.)
1 plant for Iris Garden. (Given by Mr. M. C. Bell.)
14 plants for Iris Garden. (Given by Mr. S. F. Butterworth.)
7 plants for Iris Garden. (Given by Mrs. W. M. Rasmussen.)
2 plants for Iris Garden. (Given by Mrs. H. S. Loughan.)
8 plants for Nurseries. (Given by Mrs. Ruth Brant.)
55 plants for Iris Garden. (Given by The Iris Place.)
33 plants for Iris Garden. (Given by Mr. Thomas M. Fendall.)
2 plants for Iris Garden. (Given by Mr. W. L. Eilert.)
1 plant for Iris Garden. (Given by Campos Altos Iris Garden.)
2 plants for Iris Garden. (Given by Mr. J. M. Shull.)
12 plants for Iris Garden. (Given by Mrs. Wm. H. Altamer.)
8 plants for Iris Garden. (Given by Mr. Richard M. Abbott.)
23 plants for Iris Garden. (Given by Mr. Frank W. Campbell.)
6 plants for Iris Garden. (Given by Dr. J. R. McLeland.)
4 plants for Iris Garden. (Given by Mrs. A. R. Ferriday.)
8 plants for Iris Garden. (Given by Miss Miller.)
16 plants for Iris Garden. (Given by Mrs. Frances R. Ives.)
15 plants for Iris Garden. (Given by Peonydale Iris Garden.)
5 plants for Iris Garden. (Given by Mr. C. H. Caldwell.)
11 plants for Iris Garden. (Given by Wm. H. Moon & Co.)
1 plant for Conservatories. (Given by Mrs. R. E. Deane.)
9 plants of *Philotria densa* for Conservatories. (Given by Miss K. B. Tippetts.)
1 plant for Herbaceous Grounds. (Given by Mrs. W. Gilman Thompson.)
1 plant for Herbaceous Grounds. (Given by Mr. N. E. White.)
35 plants for Rock Garden. (Given by Mrs. L. B. Wilder.)
26 plants for Iris Garden. (Given by American Iris Society.)
2 plants for Iris Garden. (Given by Mrs. W. E. Tobie.)
5 plants for Iris Garden. (Given by Mr. Clarence G. White.)
3 plants for Iris Garden. (Given by The Wing Seed Co.)
1 plant for Iris Garden. (Given by Mrs. Lewis R. Smith.)
3 plants for Iris Garden. (Given by Mr. Nathaniel Bacon.)
3 plants for Iris Garden. (Given by Mrs. W. K. du Pont.)
13 plants for Iris Garden. (Given by Mr. Willis E. Fryer.)
2 plants for Conservatories. (Given by Mr. D. B. Rosenkraus.)
3 plants for Conservatories. (Given by Mrs. L. Cunningham.)
10 plants for Rock Garden. (Given by Mrs. Chas. H. Stout.)
? plants for Nurseries. (Given by Mr. W. A. Brindwell.)
3 plants for Herbaceous Ground. (Given by Miss Alice Halsey.)
1 plant for Rock Garden. (Given by Mr. F. I. Allen.)
4 plants of Juniperus. (Given by The D. Hill Nursery.)
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ACCESSIONS

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AMERICAN TROPICAL PLANTS AT HOME—III. THE ANDEAN GENTIANS AND SOME OF THEIR ALLIES

My first encounter with a South American gentian was with the primrose-leaved species (*Gentiana primulaefolia* Griseb.), and it is not too much to say that it required a critical examination for me to recognize it as belonging to this genus. I was well acquainted with all our eastern North American species, as well as with many of those of the Rocky Mountains, and was familiar with their plicately closed or but slightly expanded rigidly erect deep-blue flowers, so that the sight of a semi-prostrate little plant bearing open campanulate or almost saucer-shaped flowers of a pale blue color, was not calculated to remind me of these acquaintances of the North. This specimen was found above timberline and within a few hundred yards of snow-banks, on the eastern cordillera of Bolivia, in early April, which there corresponds with late autumn of our year. Its general appearance, at a little distance, excepting the color of its flowers, was that of a small portulaca plant. Its flowers were suggestive of those of our cultivated Chionodoxa. Closer inspection showed it to consist of a dense rosette of small radical leaves, from which radiated a cluster of slender prostrate stems, their terminal portions upturned and bearing one to several flowers.

Later in the day, I was treated to a much greater surprise by another member of the same genus. Having crossed the divide, and descended to a more temperate region, and one reeking with humidity, I observed, on a partly shaded bank, what appeared to be a dense bed of slender moss-stems, but with tiny pale-blue flowers showing among the leaves. Once collected, its relation with the gentians was apparent, as its flowers were formed precisely like those of a miniature fringed gentian, though

relatively much more slender, and of a pale blue, with whitish tube. The stems were about as tall and slender as those of our hair-cap moss, the leaves but an eighth of an inch long, sessile and narrow, and the flowers, which were produced sparingly in the upper axils, about a half inch in length and not fringed. It proved to be *G. sedifolia*, a very common and abundant species, which I have encountered from Colombia to Chile, and always with undiminished or increasing admiration and delight.

Each of the above-named species is represented by another so much resembling it as to have led me to regard them as mere varieties or forms, when I first received them from my collector, Mr. Miguel Bang. Both were subsequently determined as new, and named by Dr. Gilg. *Gentiana Bangii* is of the *primulaefolia* type, but its branches are more ascending, its flowers more abundant and not quite so broadly open, and of a whitish or yellowish-white color. *G. gynophora* Gilg is a Bolivian species of the same type. Its radical leaves are very small, and its ascending stems filiform and nearly leafless, the solitary erect flowers open ball-shaped and more than half an inch long and broad. *G. limosellodes* HBK. differs from the preceding in its short funnel-formed flowers being borne on long erect filiform scape-like peduncles. *G. soratensis* is the one mistaken by me for *G. sedifolia*, and it must be a lovely plant as seen growing in its sphagnum beds. Its general form and habit remind one strongly of the smaller cranberry in our northern bogs, except that its very slender stems, sometimes a foot long, are not inclined to branch. They are little inclined to grow in masses like the sedum-leaved species, and the nearly filiform stems are often declined. Instead of having solitary flowers, there is a terminal cluster, and these are decidedly stouter than those of the former. *Gentiana rupicola* HBK. is a peculiar species which appears to combine the peculiarities of both the *sedifolia* and *primulaefolia* groups. Its slender stems, 2 to 4 inches in height, are densely tufted like those of *sedifolia*, but they are densely leafy, at least below, and twice as large and broad as those of the latter. The very handsome flowers are like those of *primulaefolia*, being open campanulate and erect on long slender peduncles.

The two groups already considered are not the only Andean gentians that are likely to astonish the northern visitor. There are a number of species that form what may be called the

punicea group, since *Gentiana punicea* Wedd. is the most common and best known of its members. This species was first encountered on an open, sunny and grassy, rather dry hillside, just above tree level at the eastern edge of the Bolivian plateau, at an altitude of about 10,000 feet. The picture presented by these plants, among the grasses, was so striking as to form a permanent recollection, and was quite unlikely, I should think, to suggest the gentians to any botanist. The weak and slender stems, a foot or more long, arose from a large and dense rosette of radical leaves, and bore several pairs of long, narrowly lanceolate, attenuate leaves, which were mostly more or less recurved. The axillary peduncles were very slender, long and recurved, so that the narrowly bell-shaped flowers, with spreading borders, were distinctly pendulous. In the young state, the flower-buds were erect on short peduncles, and regularly club-shaped. This anomalous appearance was increased by the strange colors of the flowers, which ranged from orange to light scarlet. These buds and flowers remind one somewhat of those of a Fuchsia. Occasionally, a form is seen with densely leafy and multiflowered stem, the long-pendulous open lower flowers contrasting with the erect upper buds, and the whole plant of a semi-pyramidal form. *Gentiana incurva* Hooker, a far less common species, is similar, but its leaves are wanting in the long attenuation of the former.

Gentiana Jamesonii Hooker, a species of Ecuador, is very similar, but stouter in every way. *G. dissitifolia* Griseb. has the crowded root-leaves long and narrow and the calyx-lobes broad, whereas those of *punicea* are narrow, attenuate and recurved. *G. diffusa* HBK. has the pendulous bell-shaped flowers of the group, but is peculiar in its short peduncles, which are solitary in the axils. The stems rarely exceed a foot in length, are clustered or branched from the base, and often prostrate or nearly so.

In spite of the frequency with which one encounters these peculiar forms, it can be said that the great majority of the Andean gentians are of similar habit and appearance to those of our northern mountains. Like the latter, they are fond of gravelly banks, in the partial shade of larger herbs or shrubs, and especially in or near running water. They commonly differ from ours in the variation of their color from the regulation blue. *G. inaequicalyx* Gilg is of gregarious habit and flowers very abun-

dantly. It closely resembles a bed of small plants of our fringed gentian, but the flowers are not at all fringed, and are much smaller. Its flowers appear to be of a rose-purple color. *Gentiana albido-coerulea* Gilg is very similar, but the flowers are twice as large and, as the name indicates, of variable mixtures of blue and white. *G. foliosa* Kunth reminds one of our own closed gentian. Its erect stems, about a foot high, are densely leafy and crowned by a dense corymb, almost a head, of rich blue flowers. *G. corymbosa* is a similar species of Colombia, as to its flowers, but it is scantily furnished with leaves, which are of a different form. *Gentiana dilatata* Griseb. produces a dense mass of stems, about 6 inches long, from a large root, these terminating in heads of medium-sized flowers, compactly arranged, the whole forming a handsomely formed bouquet. *G. tradescantiaefolia* Britton and *G. cochambambensis* Rusby are two similar species, of peculiar habit. Both have elongated, prostrate, thick stems, which incline to be rhizomatous, and clusters of weakly ascending reddish stems, sparsely clothed with much elongated narrow leaves. The former has the upper portion of the stem widely branched, the branches ending in small heads of contracted flowers. The latter, while very similar in habit, differs markedly in its flowers, which are about half an inch long, broadly bell-shaped and of whitish color, the margins beautifully marked with purplish-blue.

The consideration of these gentians may close with a reference to the two showiest species, so far as the writer's observation enables him to judge.

Gentiana Dielsiana Gilg (*G. spectabilis* Rusby)[1] has the dense rosette of radical leaves so characteristic of the Andean species, but these differ from all others that I have seen in being strictly erect. They are four to eight inches long, narrowly oblong-spatulate and taper into a long, slender petiole. The massed flowers, nearly 2 inches in length, of infundibular-campanulate form, suggested the name "*spectabilis.*"

Gentiana Kusnezovii Gilg (*G. virgata* Rusby) has the clustered stems arising from a dense rosette of elongated linear attenuate

[1] Nearly all the above-named species of Dr. Gilg were independently named and described by the present writer at the same time, neither author knowing that the other was so engaged. The appearance of Dr. Gilg's names in print a few days before mine necessarily threw the latter into synonymy.

leaves, but they are very slender and prostrate at the base, then ascending and densely leafy, bearing simple or branched, erect slender peduncles in their axils, the flowers being broadly bell-shaped, with erect, slender calyx-lobes.

The Andean gentians, like their northern cousins, are associated with some curious and interesting relatives, at least one of which is of surpassing beauty. The genus *Frasera*, so widely distributed in the United States, does not occur, but the curious little *Halenia*, with its 5-spurred corolla, is widely distributed in both regions. More curious still is the leafless and saprophytic *Leiphaimos* or *Voyria*, with its filiform stems and elongated salverform corolla, the entire plant of a yellowish-white color, and strongly reminding one of many of the *Burmanniaceae*. *Coutoubea*, a plant of Venezuela and Guiana, is a densely branched and very spiny herb, very unlikely to suggest the bland herbage of the gentians, but strongly manifesting their peculiar bitter taste.

Interest in the gentian-allies of the Andes centers chiefly in a peculiar and complex group of genera that was long aggregated under the name *Lisianthus* of Aublet, but which now has been judiciously analyzed by Gilg and differentiated into a number of genera, some of them more closely related to others than to those with which they were grouped by Bentham. The most common and widely distributed, and the best known of these, is the genus *Chelonanthus*, its numerous species encountered throughout the Andes, mostly in open, sunny and rather dry localities, on hillsides, though frequently in a quite different environment. The habit of the plants might be characterized as "gawky." They occur scattered about singly, and the stems are usually solitary, or but two or three together, nearly or quite simple, and of a pale or yellowish-green color. The flowers are on long peduncles from the upper axils, often becoming somewhat corymbose. They are, so far as my observation extends, always of a pale or greenish yellow, and have the general form of a Penstemon flower. How such plants could ever have come to be aggregated with the true *Lisianthi* of the West Indies, with such genera as *Macrocarpaea*, *Rusbyanthus*, and *Symbolanthus*, is difficult of comprehension. It is to the latter genus that attention here is particularly directed, and I cannot do better than to quote what I said of it in the enumeration of the plants collected

on my first Andean exploration: "One of the most beautiful of Andean plants and well adapted to cultivation for cut flowers." Although some seven or eight species of this genus are known, I have never encountered but one of them, and that only in a single locality, so that I am led to the opinion that they are somewhat rare or of local occurrence. *Symbolanthus Rusbyi* Gilg was encountered along the roadside between Mapiri, Bolivia, and the base of the cordillera. Here it was abundant and of luxurious growth and had every appearance of being a plant that would lend itself freely to culture in tropical gardens, or in the conservatory. A very noticeable feature was its tendency to variations in color and size of flowers, and in habit of growth, indicating the feasibility of modifying and improving its decorative qualities by selection and breeding. The plant is a soft-stemmed shrub of three or four feet in height, and commonly about as broad. It branches densely from base to summit, and is densely leafy and abundantly flowered. Its leaves are of a size well proportioned to that of the plant, thick, crisp and of waxy luster and of a very rich deep green. Its flowers are borne in the upper axils and in their general form remind one of a Mimulus flower. The calyx is rather large, somewhat prismatic, and its rich green color contrasts finely with the showy corollas. The latter are stoutly salver-form, more than an inch in length and breadth, with the mouth decidedly oblique. The texture is thick and crisp, and the color showy. The lighter flowers are of a light orange or near-yellow, while the darker ones are of a deep crimson or damask, and there are all intermediate shades. So far as I could see, these variations in shade were not due to age of flower, but were inherent in different plants. So abundant were these that the roadside was thickly bordered by them for a considerable distance, and their discovery was one of the special incidents of the day's travel.

H. H. Rusby.

NATIVE ORCHIDS OF MANHATTAN ISLAND

In the autumn of the year 1867, the year in which the Torrey Botanical Club was born, a Brooklyn school-boy was introduced to the orchid-flora of Manhattan by accompanying his uncle, the late William Wallace Denslow, in his botanical

explorations. Mr. Denslow was then residing in Inwood and was able to make an intensive study of the plants of that vicinity. The orchids in bloom in that September, so memorable to the present writer, were few in number but very attractive and characteristic. To use the names then approved, *Spiranthes gracilis* and *S. cernua* were found on the slopes near the Kingsbridge road and *Corallorrhiza odontorhiza* in neighboring woods. *Liparis liliifolia* in good fruit was seen during the same month. In one spot in the bank beside a road through the woods on the western side of the ridge, there was a very small colony of *Tipularia*, at which the boy was permitted to gaze with unsatisfied curiosity, because he was strictly enjoined from collecting any of the leaves—there were no fruiting scapes and it was too late in the season for the flowers.

The discovery in the preceding year of this beautiful species was a memorable event and the small colony was cherished with scrupulous care. The species was considered rare in this vicinity, though it was collected also later in Bedford Park and was still abundant at the earlier date on Staten Island.

These five species, representing three of the four tribes of *Orchidaceae* found in the Northeastern States, and found so soon after the writer's introduction a few weeks before to *Pogonia*, *Calopogon* and the yellow fringed orchis, in a productive swamp in East Haven, Connecticut, seem to have stimulated an ardor not only for collecting, which is a common inclination of boyhood, but also for botanical study, and are therefore remotely responsible for the writing of this article!

Mr. W. W. Denslow had found other orchids on Manhattan Island, chiefly in 1865 and during the summer of 1867. The list of these specimens, now in the Herbarium of Amherst Agricultural College, includes two of the less common species of Habenaria, *H. lacera* and *H. flava*. The latter was found in salt swamps near Spuyten Duyvil and the ragged orchis near High Bridge. Nearby was collected once *Spiranthes latifolia* (*Ibidium plantagineum*). The larger coral root, *C. maculata*, was found in two localities on Washington Heights and the other tway-blade, *Liparis Loeselii*, in the same neighborhood. The showy orchis was one of the earliest discoveries, in May, 1866, though the rattlesnake plantain, so-called, *Goodyera pubescens*, had been collected in August, 1865, near the Kingsbridge road.

Here was a very good beginning of the orchid portion of Mr. Denslow's herbarium, twelve species, one-sixth of the number listed in Gray's Manual, found within one square mile of upper Manhattan, where now the progress of building has occupied almost every square foot and 2,000 families are housed in a tract where cattle browsed in extended pastures on both sides of Broadway, fifty years ago. The only exemption from this influx of buildings and people is that small area along the Hudson River which the City is now acquiring for a park reservation; and even in this section no native orchid has been seen growing for many years.

Four other genera are represented by the species of this peculiar family that have been found in the parts of Westchester County nearest to Manhattan. These are: two Cypripediums, the early stemless one and the smaller yellow species, the beautiful Calopogon, the curious *Isotria verticillata*, the purple fringed orchis, *Habenaria psycodes*, and *Habenaria clavellata*, with its small but perky spur, in the shape of a sickle-shaped club. All of these, with little doubt, have been growing on Manhattan Island within sixty years. Here are eighteen species, more than one-fourth of the number included in Gray's Manual, representing all but seven of the genera listed there. The study of these would provide opportunity for acquaintance with the habits of characteristic and widespread North American species. There are few that have a wider range east of the Mississippi than the stemless lady's slipper, the showy orchis, the purple fringed orchis, the fragrant Spiranthes, the larger coral root. Many of the species formerly represented here by occasional plants are found elsewhere in great numbers, as Tipularia, which is very abundant in parts of Delaware and Maryland and *Habenaria psycodes*, which in many places borders roadsides and brightens large tracts of meadow land. It could not be affirmed with certainty that any of the eighteen species enumerated, with the probable exception of *Spiranthes cernua*, were ever common on Manhattan, at any time within the last two hundred years. Though the people of New York City who lived north of Hudson Street were gathered chiefly in separate villages so recently as the year 1824; though a pond covered what is now Manhattan Square and there was a covert just south of it where rabbits bred, less than forty years ago; though

Jones' Wood along the East River above Seventy-first Street was virgin forest until the eighteenth century; though there were many brooks, some swamps and some ravines; yet conditions favorable to the growth of orchids were not prevalent. Much of the surface was sand or bare rock. There have been no bogs on the Island within historic times. The forests disappeared steadily, as the demands of the growing population increased. There was scant opportunity for extended colonies of orchids; and the showier species, about one-third of those listed above, were subject then as now, though in lesser degree, to the depredations of careless pickers. In shady dells, however, and on less frequented hillsides; in the few very wet swamps here and there; the smaller, shyer members of the orchid group lived on in diminishing numbers. A century ago the lover of nature could probably have found some of them in every month from May to October in many parts of Manhattan; fifty years later, they had been destroyed by advancing civilization, except at the extreme northern end of the Island; now they have disappeared and, except for herbaria and the grateful memories of a few botanists, might soon be forgotten. All of the species named are still discoverable within thirty miles, some within ten miles, of Inwood Hill. But they are members of a vanishing race; unless we treat them with greater care and kindness than were shown to the Indian owners of Manhattan, they too will disappear. It is a pleasure to record here that some of the hardier ones have been seen recently in great abundance on the edge of the surburban district, and that so recently as the year 1868 the orchid-hunter was able to find on Manhattan Island, not infrequently, some scattered specimens of his favorite friends, making their last stand against open and subtle foes, lack of shade, lack of moisture, loss of plant associations and the axe and spade and trowel of "civilized" men.

H. M. DENSLOW.

REPORT ON A VISIT TO ENGLAND AND FRANCE

DR. N. L. BRITTON,
Director-in-Chief.

Sir: As directed by yourself and with the authorization of the Board of Managers of The New York Botanical Garden,

I spent over three months of the summer of 1924 in studies on the flora of northern South America at the Royal Botanic Gardens, Kew, England, and the Muséum d'Histoire Naturelle, Paris France. Leaving New York, Saturday, May 3, I arrived in London Friday, May 9, and began work at Kew Monday, May 12. Except for small interruptions during the meeting of the Imperial Botanical Congress, my studies progressed continuously until early in August, when I proceeded to Paris for five days' work at the Muséum. After spending another week in completing my work at Kew, I left London Saturday, August 23, and arrived in New York Sunday, August 31.

By far the greater part of my efforts were directed to the identification of plants from the Guianas, especially British Guiana, from which country we have received several thousand specimens during the past few years. The great herbarium at Kew contains the most complete representation of the early collections from British Guiana, including those of Parker, Appun, Robert and Richard Schomburgk, and Im Thurn, among which the long series of plants collected by the Schomburgks are of primary importance. They were studied by Bentham shortly after their receipt at Kew and contain numerous types. Without an examination of these authentic specimens, any identification of our recent collections would be difficult or impossible. It was a source of much gratification to find that approximately two thirds of our unidentified Guiana material could be accurately referred to previously described species. Since most of these were not represented by named specimens in our collection before, my work has provided our herbarium with a large number of named species which will serve as a point of departure for our future investigations.

About one third of our plants could not be satisfactorily referred to any species at Kew. While this does not show conclusively that these are all new and unnamed species, it does indicate that the flora of the Guianas includes many unknown species, and permits us to proceed with more assurance to their further study.

Besides the Guiana material from our herbarium, I took with me a series of specimens of the genera *Siphocampylus*, *Centropogon*, and *Vernonia*, and of the family Melastomaceae from northern South America, particularly from Colombia, whence

they had been obtained for us by the recent expeditions into that and neighboring regions by Rusby, Rose, Pennell, White, Hitchcock, and others. I was able to identify satisfactorily a large number of melastomes at Kew, and was particularly successful in arranging our specimens of the complex genera *Siphocampylus* and *Centropogon*. In this I was greatly aided by the loan of specimens from Berlin and Vienna, obtained for me by the administration at Kew, and by the examination of the type specimens of Humboldt and Bonpland at Paris. Several species of *Vernonia* were also named, but numerous others must wait for comparison with types not available at either of the two institutions visited by me.

The re-incorporation of our material into our herbarium, the identification of other specimens on the basis of my studies, and the description of new species will occupy my time for some months in the future.

Through the courtesy of the committee in charge of the Imperial Botanical Congress, held in London in July, I was invited to attend its sessions, and I listened with great appreciation to the papers and to the discussions of the various problems now before the British botanists. I especially enjoyed the opportunity of meeting personally many of the leading botanists of Great Britain and her numerous colonies.

In my visit at Paris, I was hospitably received by Professor F. Gagnepain, in the absence of the director, Professor Henri Lecomte, and given every possible facility for my work. At Kew also, I was received with the greatest cordiality by Captain A. W. Hill, director, and Major T. F. Chipp, assistant director, and given free access to the magnificent collections by Dr. Cotton, keeper of the herbarium, and Mr. Skan, librarian. I am also deeply grateful for much personal assistance in many ways by Mr. N. E. Brown and by Messrs. Wright, Hutchinson, and Sprague, of the herbarium staff.

Respectfully submitted,

H. A. GLEASON.

September 9, 1924.

THE HUDSON RIVER VALLEY BEFORE THE ADVENT OF MAN[1]

The Hudson River valley is a very ancient topographic feature of this region, whereas man, geologically considered, was born but yesterday; hence we do not have to hark back very far in geologic time—only some hundreds of thousands of years at most—to arrive at a period in the history of the region when man had not yet appeared upon the scene.

Vespucci in 1497, John Cabot in 1497–98, and Sebastian Cabot in 1517 touched at various points on the east coast of North America; but the earliest written description of the Hudson River region was by the Italian navigator Giovanni di Verazzano, who sailed along the coast from the Carolinas to Newfoundland in 1524. What we know as New York Bay or Harbor is designated on the map of his voyage as "Sangamano," in connection with which he says: "after coasting along the shore to the northeast for a hundred leagues we found a very pleasant situation among some steep hills, through which a very large river, deep at its mouth, forced its way to the sea . . . . We passed up this river about half a league, when we found it formed a most beautiful lake, three leagues in circuit . . . . Weighing anchor we sailed eighty leagues towards the east, as the coast stretched in that direction."

Eighty-five years subsequently, in 1609, Henry Hudson visited the same region and sailed up the river almost as far as to the site of the present city of Albany. Neither of these first two white men who viewed the river saw any topographic features that were different from those of today, however, and they found the region peopled by savages whose traditions included no mention of a time when their ancestors did not inhabit the region. The first question to be decided, therefore, in connection with our story, is how far back in geological time it would be advisable to go for our starting point. The limited time at our disposal precludes the possibility of starting at the period when the Hudson River valley was first outlined as a topographic feature.

In Europe archaeologists have, apparently, proved the existence of man in the Tertiary period; but on this continent

[1] Abstract of a lecture given at The New York Botanical Garden on Saturday afternoon, August 30, 1924.

we can not claim, definitely, any proof of man's presence previous to the Quaternary period. We may, therefore, begin our story with what we know or infer in regard to conditions that obtained here towards the close of the Tertiary period.

If a map of New York State is examined it may be seen that the Hudson is an abnormally straight river. For a distance of about 180 miles—from Saratoga to Manhattan—it follows an almost straight line, despite the rugged topography through which its channel is cut. This apparently means that an ancient fault line was what determined its original course, after which the river, in the lapse of ages, eroded its valley into the form and dimensions that it has today. The river and its valley as we see them, however, are very different in many of their features from what their appearance was, even as recently as in the Tertiary period.

The underground work in connection with the Catskill aqueduct revealed many interesting and some startling facts. At the site of the Storm King crossing, where the aqueduct passes under the river, it was necessary that this concave section, or siphon, should be in solid rock. Soundings and borings in the river bed showed clay, sand, gravel, and bowlders to a depth of about 770 feet below the level of the river in the middle of the channel, and at constantly diminishing depths toward each bank. Below was a solid rock floor, as verified by diamond drill borings, driven through the rock from each side of the river until they crossed at a depth of about 800 feet. The depth and contour of the old river valley at this point was thus revealed. It was a gorge or canyon 800 to 1,000 feet in depth, if we take into account the adjacent highlands. The Palisades, which appear impressive to us with their sheer height of 300 to 400 feet, must have towered at least 1,200 feet above the old river level. River erosion necessarily implies elevation of the land. When a river has eroded its channel down to sea level, erosion ceases and deposition of sediments begins. The conclusion, therefore, is inevitable that when this old river channel was eroded the land in this region must have been at least 800 feet higher than it is today. Under such conditions the question will naturally be asked, where was the coast line and where did the river enter the ocean? The answer to this question is supplied by the submarine soundings and contours off the adjacent

shores. These show that for a distance of about 75 to 100 miles out from the present coast line the water is comparatively shallow, and the slope of the ocean bottom is gradual and uniform—only about 6 feet to the mile—until the vicinity of the 100-fathom contour is reached. Then there is a sudden drop, in the next 25 or 50 miles, to a depth of 1,000 fathoms and more. This submerged plateau, terminating in a steep escarpment, represents the old continental coastal plain and shore line, at the period when the land stood hundreds of feet higher than it does now. Through this plain the rivers cut their way to the ocean, and one of the most clearly defined of these old river channels may be traced on the ocean bottom, by means of the submarine contours, from the present mouth of the Hudson to its ancient outlet at the coast line of the old continental plateau, about 100 miles to the southeast. We have seen that we must have had an elevation of at least 800 feet in order to account for the depth of the old river valley at Storm King. Suppose then we imagine the land and its adjacent submarine plateau to be elevated 800 feet above its present level. Eight hundred feet—133 fathoms. The coast line would then be exactly where we would have anticipated—just beyond the present 100-fathom contour. Such were the topographic conditions in this region in the Tertiary period. The climate was mild and equable, as indicated by the animal and plant remains, not only in this region, but also throughout the entire Northern Hemisphere. Great changes were impending, however. Coincident with, or immediately following the era of maxium elevation snow and ice began to accumulate on the Canadian highlands. Then further south on the Adirondacks, Catskills, and Shawangunks; and ultimately a continuous continental glacier was formed. The Ice Age or Glacial Epoch of the Quaternary period had become established. Life in the north was obliterated and to the south was modified in many of its features. In this region the ice pushed its way as far south as what is now New York Bay, and reached its point of furthest southern extension in eastern North America on Staten Island. No chapter in geologic history is more clearly written in records of natural phenomena, and few of the phenomena of geology are more readily interpreted than are those of the Glacial Epoch. The advancing ice scored and grooved the hard rocks over which it passed; rounded their

surfaces; deepened and widened the valleys through which it flowed; blocked old drainage channels and caused new ones to be formed, and carried along with it fragments of the rock outcrops that it encountered in its travels, finally depositing the debris at the ice front in the form of a ridge or irregular chain of hills that we know as the terminal moraine. An era of continental depression then began, with minor ups and downs. Several times the ice receded and advanced, leaving records behind it, but finally it receded permanently and existing conditions were established. It was at some time during this period, immediately after the final retreat of the ice, that primitive man made his first appearance in this region, as indicated by relics found in Quaternary gravels of the old river terraces, and there our story must end.

The lecture was illustrated by lantern slides that included Verazzano's map, section of the Catskill aqueduct at the Storm King crossing, chart showing the submarine contours off the New Jersey, Long Island, and New England coasts, sections across the old continental plateau from the present shore line to the 1,500-fathom contour, ideal landscapes during the Tertiary and Quaternary periods, examples of glacial phenomena in the vicinity of New York, and diagrams explaining the meaning and extent of geologic time.

ARTHUR HOLLICK.

PUBLIC LECTURES DURING NOVEMBER

The Garden lectures on Saturdays during the month of November will take the form of walks and demonstrations with special reference to the announced subject of the day. The audiences will meet in the Lecture Hall of the Museum Building as usual except that the hour is three instead of four. The program follows:

Nov. 1. "The Rock Garden." Dr. E. B. Southwick.
Nov. 8. "The Hardy Chrysanthemums."
Mr. K. R. Boynton.
Nov. 15. "The Hemlock Grove." Dr. H. A. Gleason.
Nov. 22. "The Pinetum: The Collection of Evergreen Trees."
Dr. N. L. Britton.
Nov. 29. "The Geology of The New York Botanical Garden."
Dr. Arthur Hollick.

NOTES, NEWS, AND COMMENTS

Miscellaneous rare plants and seeds from southern Texas have been presented to the Garden by Mr. R. Runyon for growing and for illustration in *Addisonia*.

Professor C. H. Ostenfeld, Director of the Copenhagen Botanical Garden, spent a few days with us in September, especially occupied in herbarium studies of Arctic plants.

Fine fruits of the Panamanian mahogany (*Swietenia macrophylla*) from along the old Spanish trail across the Isthmus of Panama have recently been presented to the Garden by Mr C. D. Mell.

Mr. F. J. Crider, Director of the Boyce-Thompson Southwestern Arboretum in Arizona, visited the Garden in September especially interested in the collections of cacti and other desert plants.

Clusters of the fruits of the needle-palm (*Rhapidophyllum Hystrix*) from the Turnbull Hammock near Titusville, Florida have recently been presented to the Garden by Mr. L. A Coleman, who is one of the original settlers of the Indian River region of Florida.

Major T. F. Chipp, Assistant Director of the Royal Botanic Gardens, Kew, England, visited The New York Botanical Garden on Saturday, September 13th, 1924, and was escorted through the grounds, buildings, and collections by members of the staff.

Dr. Nathaniel L. Gardner, Assistant Professor of Botany in the University of California, and well known as a writer on the algae of the Pacific Coast, spent a month at the Botanical Garden in September and October, engaged especially in a study of the blue-green fresh-water algae collected in Porto Rico by the late Professor N. Wille of Christiania.

Dr. Marshall A. Howe, Assistant Director, acted as one of the judges at the following dahlia shows during September Massachusetts Horticultural Society, at Boston; Philipstown Garden Club at Peekskill, N. Y.; American Dahlia Society in the 71st Regiment Armory, New York City; Rumson Garden

Club at Rumson, N. J.; and Short Hills Garden Club, at Short Hill, N. J. He lectured on "Dahlias and Their Culture" before the Massachusetts Horticultural Society on September 13 and 14.

Aided by a grant from our Exploration Fund, Professor M. A. Chrysler of Rutgers College, spent part of August in western Cuba, prosecuting studies upon the Cycads of that region. He obtained for us plants of two native species of *Zamia* and of *Microcycas calocoma;* our esteemed correspondent, Dr. Juan T. Roig, Botanist of the Cuban Agricultural Experiment Station, gave him valued assistance. Returning north, Professor Chrysler obtained for us plants of two other species of *Zamia* in Florida.

Mr. Otto Degener, who is spending the year at the Botanical Garden, studying his collections of Hawaiian plants, addressed the Torrey Botanical Club on October 29 on "Plant Collecting in Hawaii." After graduation from the Massachusetts Agricultural College with the degree of B.S. in 1922, Mr. Degener made plant collections in the Canadian Rockies and on Mt. Rainier in Washington and then proceeded to Honolulu for a year's graduate work in botany and zoology at the University of Hawaii, from which he received the degree of M.S. in 1923. During that period he made collections on the islands of Oahu, Hawaii, Maui, and Kauai. During the past year he has been a graduate assistant in botany in the Massachusetts Agricultural College.

The following visiting botanists enrolled in the library during the summer: Miss Mabel A. Rice, Wheaton College, Mass.; Prof. N. M. Grier and class, Cold Spring Harbor, N. Y.; Professors H. M. Fitzpatrick, H. H. Whetzel, L. W. Sharp, and L. F. Randolph, Ithaca, N. Y.; Prof. Frank D. Kern, State College, Pa.; Messrs. John C. Wister and John M. Fogg, Jr., Philadelphia, Pa.; Dr. J. N. Rose, Prof. E. O. Wooton, Dr. W. T. Swingle, and Miss Anna E. Jenkins, Washington, D. C.; Prof. A. E. Waller, Columbus, Ohio; Prof. Bruce Fink, Oxford, Ohio; Dr. Earl E. Sherff, Chicago, Ill.; Mr. Willard N. Clute, Joliet, Ill.; Prof. John T. Buchholz, Fayetteville, Ark.; Prof. H. S. Reed, Riverside, Cal.; Mr. Chas. S. Parker, Seattle, Wash.; Prof. Harold L. Lyon, Honolulu, T. H.; Mr. Lawrence Ogilvie, Bermuda; Prof. P. A. Bourne and Mr. T. B. McClelland, Mayagüez, P.

R.; Mr. Raphael A. Zon, Rio Piedras, P. R.; Miss H. P. Sorokin, Univ. of Petrograd, Russia; and Prof. Dr. H. Glück, Heidelberg, Germany.

Meteorology for August. The total precipitation for the month was 5.06 inches. The maximum temperatures recorded for each week were *98° on the 7th*, 87° on the 11th, 83° on the 21st and 94° on the 30th. The minimum temperatures were 62° on the 9th, 55° on the 16th, *51° on the 19th* and 57.5° on the 27th.

Meteorology for September. The total precipitation for the month was 3.76 inches. The maximum temperatures recorded for each week were *96° on the 1st*, 85.5° on the 13th, 77° on the 18th and 74° on the 22nd. The minimum temperatures were 46° on the 6th, 43.5° on the 11th, 49° on the 16th, on the 18th and on the 20th, *and 42° on the 24th and on the 25th.*

Meteorology for October. The total precipitation for the month was 0.25 inch. The maximum temperatures recorded for each week were 75° on the 2nd and on the 3rd, *82.5° on the 6th*, 74° on the 15th and on the 17th, and 78° on the 26th. The minimum temperatures were 42° on the 2nd, 43° on the 9th, 33.5° on the 18th and *30° on the 23rd.* There was a very slight frost on the morning of the 14th, when the temperature was 37°, and two other slight frosts, which injured some of the Dahlias, on the mornings of the 18th and the 23rd.

ACCESSIONS

Museums and Herbarium

12 photographs of American plants. (By exchange with the United States National Museum.)

5 specimens of flowering plants from Iowa. (Given by Mr. B. D. Walden.)

53 specimens of plants from Australia. (Collected by Mr. F. M. Reader.)

47 specimens of *Carex* from Alberta. (Collected by Mr. A. H. Brinkman.)

11 specimens of flowering plants from Wyoming and Montana. (By exchange with Mr. Elam Bartholomew.)

60 specimens of flowering plants from Idaho. (By exchange with Mrs. M E. Soth.)

39 specimens of flowering plants from Wyoming. (Given by Professor J F. Kemp.)

9 specimens of flowering plants from Colorado. (Given by Miss Hazel M. Schmoll.)

58 specimens of flowering plants from Utah. (By exchange with Professor A. O. Garrett.)

Plants and Seeds

1 plant for Conservatory. (Given by Mr. George G. Heye.)
1 plant for Conservatory. (Given by Mrs. T. S. Dayton.)
36 bulbs for Lily Garden. (Given by Mrs. M. J. Fox.)
2 plants for Conservatories. (Collected by Dr. N. L. Britton.)
1 plant for Herbaceous Ground. (Collected by Mr. Geo. Friedhof.)
23 plants for Nurseries from Florida. (Collected by Miss Winifred Kimball.)
1 plant for Rock Garden. (Collected by Miss M. E. Eaton.)
1 plant for Nursery from North Carolina. (Collected by Mr. C. D. Beal.)
1 plant for Herbaceous Grounds. (Collected by Mr. K. R. Boynton.)
2 plants for Conservatories from Florida. (Collected by Mr. C. A. Mosier.)
3 plants for Rock Garden. (Collected by Dr. A. Hollick.)
5 plants for Herbaceous Ground and Rock Garden. (Collected by J. Hartling.)
16 plants for Conservatories from North Carolina. (Collected by Dr. J. K. Small.)
5 plants for Nurseries. (Collected by Mr. R. W. Shreve.)
1 plant for Rock Garden. (Collected by Mr. John V. Borin.)
291 plants from Florida. (Collected by Dr. J. K. Small.)
115 plants for Herbaceous Grounds. (Collected by Mr. Percy Wilson.)
3 plants for Herbaceous Grounds. (Collected by Wilson & Borin.)
11 plants for Rock Garden. (Collected by Mr. John G. Borin.)
13 bulbs for conservatories. (Collected by Dr. J. K. Small.)
113 plants for Conservatories. (By exchange with U. S. Dept. Agric.)
21 plants for Conservatories. (By exchange with Dr. David Fairchild.)
2 plants for Conservatories. (By exchange with Mr. W. Wolf.)
13 plants for Conservatories. (By exchange with Federal Horticultural Board.)
11 plants for Conservatories. (By exchange with Mr. J. H. Ferriss.)
4 plants for Fruticetum. (By exchange with Prof. D. S. Johnson.)
2 plants for Conservatories. (By exchange with Chas. Deering Estate.)
4 plants for Rock Garden. (By exchange with Dept. of Parks, Bronx.)
3 plants of *Echeveria Bartramii*. (By exchange with Mr. E. B. Bartram.)
5 plants for Conservatories. (By exchange with Mr. E. J. Palmer.)
5 plants for Conservatories from Mexico. (By exchange with Mr. A. F. Moeller.)
2 plants for Nurseries. (By exchange with Mr. H. Bird.)
7 plants for Nurseries. (By exchange with University of Texas.)
11 plants for Nurseries. (By exchange with Prof. G. E. Nichols.)
2 plants for Nurseries. (By exchange with Mr. C. A. Ludwig.)
2 plants for Nurseries. (By exchange with Dr. E. T. Wherry.)
67 bulbs of *Caladium*. (By exchange with Mr. H. Nehrling.)

3 plants for Nurseries. (By exchange with Mr. E. C. Leonard.)
6 plants for Conservatories. (By exchange with Armstrong Nurseries.)
13 plants for experiments. (By exchange with Experiment Station in Hawaii.)
1 plant for Conservatories. (By exchange with Mr. W. B. Thompson.)
2 plants for Conservatories. (By exchange with Mr. J. B. Cobb.)
1 plant for Conservatory. (By exchange with the Misses Noble through Dr. N. L. Britton.)
27 plants for Conservatories. (By exchange with Mr. H. Nehrling.)
1 plant from Cuba. (By exchange with Prof. Roig.)
560 plants for Pelham Ave. Entrance. (Purchased.)
21 plants for Roads & Paths. (Purchased.)
6 plants for Pinetum. (Purchased.)
300 plants for Pinetum. (Purchased.)
360 plants derived from seed.
1 packet of seed. (Given by Mr. O. W. Barrett.)
1 packet of *Agave* seed. (By exchange with Dr. Wm. Trelease.)
1 packet of seed. (By exchange with Division of Botany, Pretoria.)
6 packets of seed. (By exchange with Mr. Robt. Runyon.)
2 packets of seed. (By exchange with Mr. T. D. A. Cockerell.)
1 packet of seed. (By exchange with U. S. Dept. Agric.)
16 packets of seed. (By exchange with Mr. T. D. Hatfield.)
140 packets of seed. (By exchange with Mr. R. Salgues.)
99 packets of seed. (By exchange with Botanical Garden, Edinburgh.)
96 packets of seed. (By exchange with Vilmorin & Andrieux Co.)
127 packets of seed. (By exchange with Brooklyn Botanic Garden.)
480 packets of seed. (By exchange with Royal Botanic Gardens, Kew.)
14 packets of seed. (By exchange with Botanical Garden, Argotti.)
438 packets of seed. (By exchange with Botanical Garden, Ottawa.)
259 packets of seed. (By exchange with Museum of Nat. History at Paris.)
42 packets of seed. (By exchange with Hort. Bot., University of Brno Kounicova.)
114 packets of seed. (By exchange with Botanical Garden, Göteborg.)
175 packets of seed. (By exchange with Botanical Garden, Leiden.)
159 packets of seed. (By exchange with Botanical Garden, Christiania.)
62 packets of seed. (By exchange with Botanical Garden, Cambridge, England.)
321 packets of seed. (By exchange with Botanical Garden, La Mortola.)
87 packets of seed. (By exchange with Dr. R. R. Stewart.)
29 packets of seed. (By exchange with Mr. Arthur S. Fairchild.)
1 packet of seed from South America. (Collected by Dr. H. H. Rusby.)
2 packets of seed from Porto Rico. (Collected by Dr. N. L. Britton.)
1 packet of seed. (Collected by Mrs. N. L. Britton.)
653 packets of seed. (Purchased.)
50 packets of seed. (Given by Mrs. W. H. Peckham.)

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THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

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Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

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A **museum**, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An **herbarium,** comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 34,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

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Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
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I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ————

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN

BRONX PARK, NEW YORK CITY

VOL. XXV DECEMBER, 1924 No. 300

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

THE BARTRAM OAK

ARTHUR HOLLICK

ECOLOGICAL INVESTIGATION IN THE HEMLOCK FOREST

H. A. GLEASON

THE 1924 DAHLIA SEASON

MARSHALL A. HOWE

BERTRAND H. FARR

A. B. STOUT

THE NARCISSUS COLLECTION

KENNETH R. BOYNTON

PUBLIC LECTURES DURING DECEMBER

NOTES, NEWS, AND COMMENT

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THE BARTRAM OAK

"My Good Friend John:—

"Pray what is the reason I have no acorns from that particular species of Oak that Doctor Mitchell found in thy meadow? And I observe, in thy specimens, two other narrow-leafed Oaks. As I have now ground enough, I wish for a dozen good acorns of each . . .

"Thine,

"P. Collinson."

Thus wrote Peter Collinson, the English botanist, to his friend John Bartram, in 1751. Bartram's farm was at Kingsessing, on the Schuylkill River, about four miles above Philadelphia; and the oak mentioned by Collinson was at that time, and for nearly a century afterwards, the only mature tree of its kind known to botanists. It was first described and figured and given a specific name by F. André Michaux, in his North American Sylva, published in the early part of the nineteenth century. In this work he says: "BARTRAM OAK. *Quercus heterophylla*. Every botanist who has visited different regions of the globe must have remarked certain species of vegetables which are so little multiplied that they seem likely at no distant period to disappear from the earth. To this class belongs the Bartram Oak. Several English and American naturalists who, like my father and myself, have spent years in exploring the United States . . .have, like us, found no traces of this species except a single stock in a field belonging to Mr. Bartram . .Several young plants, which I received from Mr. Bartram himself, have been placed in our public gardens to insure the preservation of the species."

The original tree was cut down about the year 1840. Many botanists, however, had examined specimens from it and its im-

FIGURE 1. 19-year-old seedling of Bartram Oak, resembling *Quercus Phellos*. (See text, p. 311.)

mediate progeny, and a considerable diversity of opinion was expressed in regard to its probable status as a species, a variety, or a hybrid. Michaux, as above cited, gave it specific rank. Nut-

tall asked: "May not this be an anomalous variety of *coccinea*?" Pursh remarked: "it is probably only a hybrid plant." Torrey regarded it, unequivocally, as a hybrid. Gray, in the first edition of his Manual, published in 1848, says: " . .doubtless a hybrid between *Q. Phellos* and *Q. falcata*, or some other species of that section." In the second edition of the Manual, published in 1856, he says: " . . .apparently a hybrid between *Q. Phellos* and *Q. tinctoria*?" And in the fifth edition, published in 1867, he cites De Candolle as referring it to a variety of *Q. aquatica*, and then remarks: "it is as likely to be a variety of *Q. Phellos*, with dilated and toothed or cut leaves."

At about this period, however, other trees were discovered, at scattered localities in New Jersey and Delaware; but this additional material only led to still further differences of opinion on the part of those who studied the trees and specimens derived from them. Engelmann first considered the tree as a good species, but later decided that it was a hybrid, with probably *Q. Phellos* and *Q. coccinea* for parents. Leidy regarded it as a hybrid, probably between *Q. Phellos* and *Q. palustris*. Buckley said, in describing a tree at Mount Holly, N. J.: "it is . . .in a thicket near several willow oaks (*Quercus Phellos*), of which it is plainly one." Cope, also was inclined to regard it as a variety or form of the same species; and a number of other botanists might be quoted as naming *imbricaria*, *nigra*, *palustris*, or some other oak with bristle-tipped leaves, as a species from which it might have been derived.

In 1880 a stand of about twenty trees of *Quercus heterophylla* was discovered by Mr. W. T. Davis, in the vicinity of Tottenville, Staten Island, and these afforded abundant material for study. The writer was fortunate in securing specimens of leaves and acorns from most of the trees, and critical examination of these resulted in the publication of a paper,[1] in which the opinion was expressed that the superficial characters indicated that the trees were hybrids, with *Q. Phellos* undoubtedly one of the parents and *Q. rubra* apparently the other, both of which species were growing in the immediate vicinity. Conclusive proof, however, was lacking, and it is of interest to note, in view of subse-

[1] Hollick, Arthur. A Recent Discovery of Hybrid Oaks on Staten Island. Bull. Torrey Bot. Club **15**: 303–309. *pl. 83–85*. 4 D 1888.

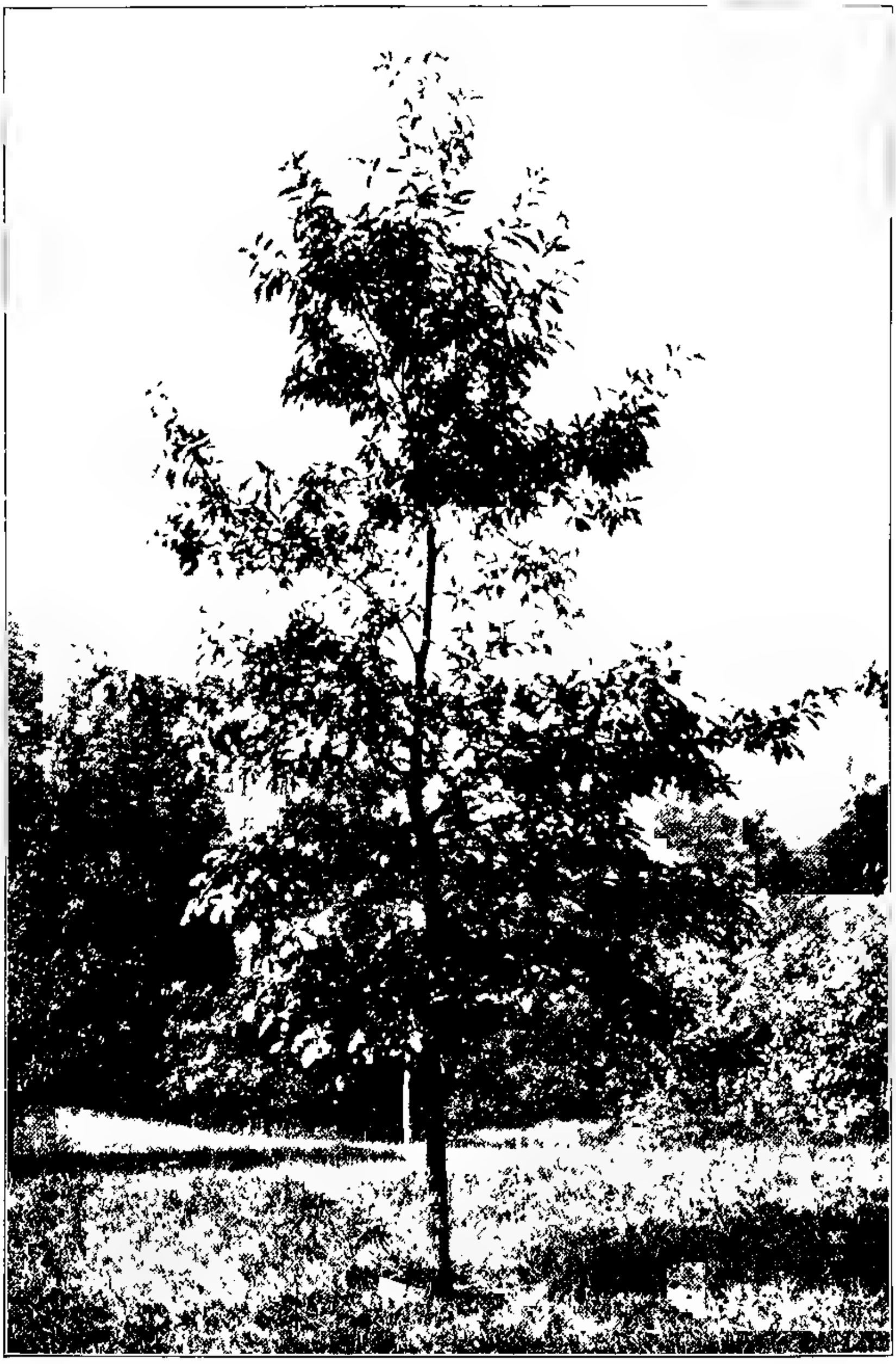


FIGURE 2. 19-year-old seedling of Bartram Oak, resembling typical *Quercus heterophylla*. (See text, p. 311.)

quent developments, that in *Garden and Forest* for January 9, 1889, in an editorial review of the paper mentioned, the probable hybrid origin of the trees was discussed, and the conclusion was expressed that their origin and parentage could not be accurately determined, "and must always, of necessity, remain a matter of personal opinion." This conclusion, however, was not shared by those who were engaged in research and investigation at The New York Botanical Garden, and in October, 1905, Dr. N. L. Britton, Dr. D. T. MacDougal, and the writer made a trip to the Staten Island locality and collected about seventy-five acorns from a typical tree of *Q. heterophylla*. These were germinated in the propagating house of the Garden, and about fifty seedling trees were thus obtained, which were available for study the following year. The result was that some were recognized as indistinguishable from the willow oak (*Q. Phellos*), others were apparently identical with the red oak (*Q. rubra*), and others were intermediate in leaf form between them, showing every possible gradation between those that were entire or wavy-margined and those that were more or less lobed.[1] The hybrid origin and parentage of the tree from which the acorns were collected was definitely proven and the status of *Quercus heterophylla*—the Bartram oak—was conclusively established, and was at last removed from the realm of mere personal opinion, after a lapse of more than 150 years from the time when Peter Collinson asked for some acorns from the "particular species of oak" that was growing in John Bartram's meadow.

A number of these seedling trees were subsequently set out in the oak plantation in the eastern part of the Garden, where they would all have equal opportunity to grow and develop. In a very short time the fact became apparent that the trees that simulated the willow oak most closely were conspicuously lacking in vigor, while those that approached most nearly the appearance of the red oak showed every indication of healthy growth. These conditions are what might be expected from their parentage. The willow oak is a southern type of the genus, which reaches the northern limit of its natural range in the warm sandy soil of the

[1] These were described and figured by D. T. MacDougal, in an article entitled "Hybridization of Wild Plants," published in the Botanical Gazette (**43**: 49 53. *f. 1–3*. Ja 1907).

FIGURE 3. 19-year-old seedling of Bartram Oak, resembling *Quercus rubra*. (See text, p. 311.)

Coastal Plain region of Staten Island and Long Island and is, therefore, not in a congenial environment, further north, in the cold, rocky soil of the Bronx, at an elevation of 100 feet or more above sea level. The red oak, however, is a more northern type of tree, that ranges to as far north as Canada, and is thoroughly at home in mountainous and rocky localities, and thrives in this region.

Three of our trees are yet living, and as they are all progeny of one and the same tree, and are all of the same age (nineteen years), their present appearance has seemed to be worthy of record, especially as it is doubtful if all will live to maturity.

FIGURE 1 represents the tree that is most nearly like *Q. Phellos* It is approximately 12 feet in height, 7½ inches in circumference at a distance of 2 feet from the ground, and has a maximum spread of branches of about 7 feet. It is evidently having a hard struggle to maintain its existence. Three times the leading branch, which should have developed into an upright and formed the trunk of the tree, has died or become aborted, and a lateral has continued the upward growth. These laterals have all grown from the same side and hence the tree presents a peculiar one-sided aspect, similar to the asymmetrical sympodial growth that is generally characteristic of the branches of the tulip tree (*Liriodendron*) during its mature years. New York Botanical Garden, 03868. E218 No. 1. Photograph by A. B. Stout, October 8, 1924.

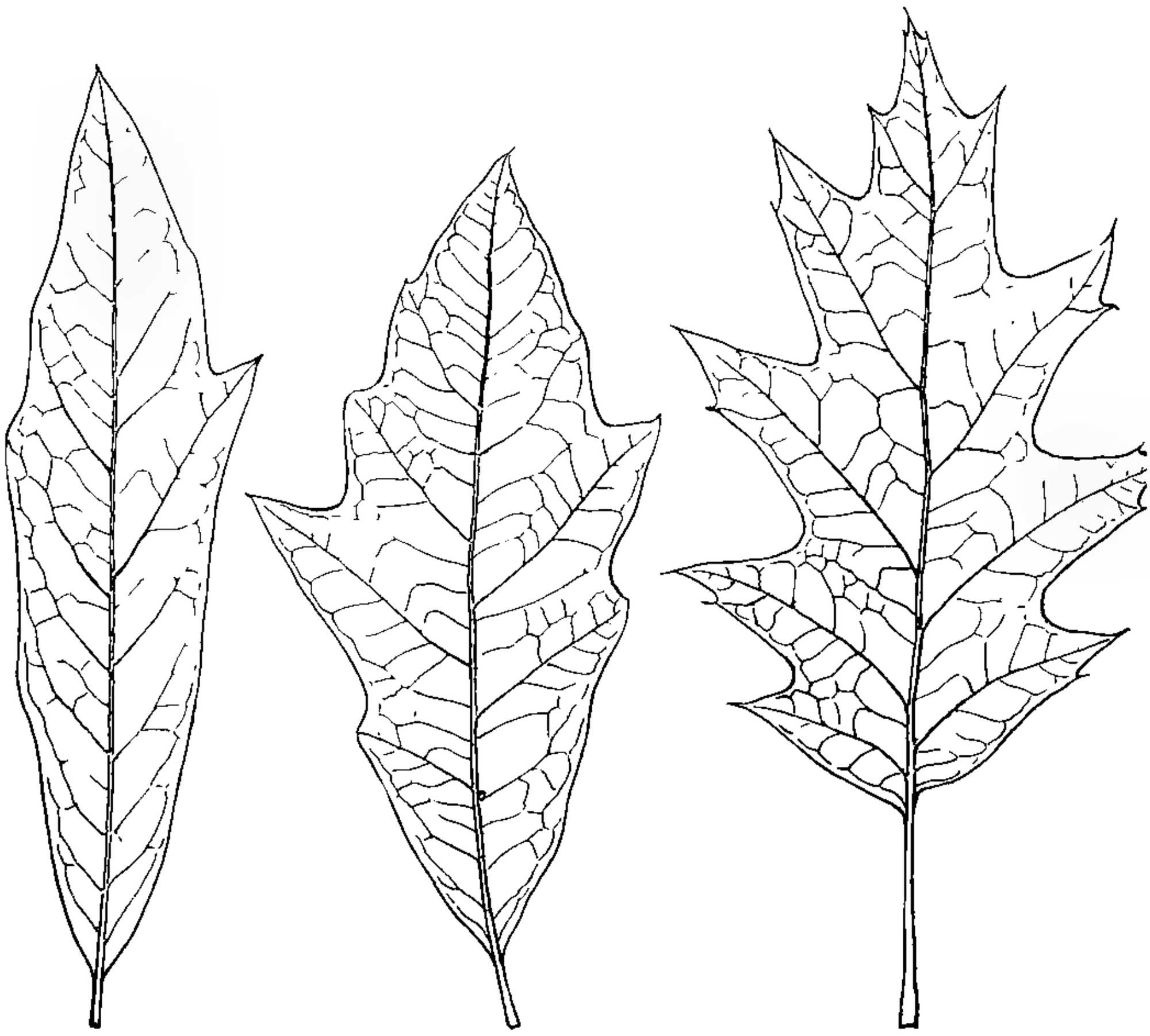
FIGURE 2 represents the tree that may be regarded as most typical of *Q. heterophylla*. It is approximately 20 feet in height, 15½ inches in circumference at a distance of 2 feet from the ground, and has a maximum spread of branches of about 12 feet. It is slender, but has the appearance of a thriving, healthy tree. Recorded number uncertain. Photograph by A. B. Stout, October 8, 1924.

FIGURE 3 represents the tree that can hardly be distinguished from *Q. rubra*. It is approximately 18 feet in height, 26 inches in circumference at a distance of 2 feet from the ground, and has a maximun spread of branches of about 20 feet. This is a vigorous stocky tree that, barring accident, ought to live its normal span of life. New York Botanical Garden, 03869. E218 No. 6. Photograph by A. B. Stout, October 8, 1924.

FIGURE 4 includes figures of leaves, reduced in size, characteristic of the trees shown in the three preceding figures.

FIGURE 4A represents a leaf from the tree shown in FIGURE 1; although others could have been selected from the same tree that were either entire or had lobate dentitions on each side. They average about 6 inches in length, including a $^{5}/_{16}$-inch petiole.

FIGURE 4B represents a leaf from the tree shown in FIGURE 2.



A B C

FIGURE 4. Leaves from three 19-year-old seedlings of Bartram Oak. (See text, pp. 311–312.)

The leaves are exceedingly diverse in outline. Relatively few are entire or wavy-margined, and some are more conspicuously lobed or indented than the one selected for illustration; but this one is fairly typical of the mass of the foliage. They average about 5½ inches in length, including a $^{7}/_{16}$-inch petiole.

FIGURE 4C represents a leaf from the tree shown in FIGURE 3, and is a good example of the foliage as a whole, which differs in its individual leaves to a relatively small extent. They average about 6¼ inches in length, including a $1^{3}/_{8}$-inch petiole.

It will remain, now, for future botanists to watch and guard these trees, and, if they live to maturity, collect and germinate acorns from them, and continue the investigation of their inherited characters through the succeeding generation.

ARTHUR HOLLICK.

ECOLOGICAL INVESTIGATION IN THE HEMLOCK FOREST

Two years ago the Scientific Directors of the New York Botanical Garden appointed a committee, consisting of Mr. Barrington Moore, Professor Herbert M. Richards, Dr. H. A. Gleason, and Dr. A. B. Stout, to conduct an investigation into the ecological relations of the Hemlock Forest. A part of the results of this investigation has now been published[1] by the Garden and a brief digest of some of its features is presented here.

The Hemlock Grove in Bronx Park has long been known as one of the interesting natural features of the region. Not only does it present a picturesque variation in the scenery, but it is unique in its isolation from other bodies of hemlock and in its proximity to salt water. The conservation and perpetuation of the grove are accordingly a matter of considerable moment, since its destruction may be caused not only by improper handling under urban conditions but also by the usual normal processes of nature.

Before a proper method for its successful conservation can be determined, it is obviously necessary to understand as fully as possible the conditions of the environment in which hemlock grows, not only in this New York station, which lies at the very edge of the range of hemlock, but in other parts of the eastern states as well. For this, the coöperation of the Yale Forestry School, the New York State College of Forestry, and the Department of Forestry of Cornell University was secured. Actual observation of the environment was carried on at New York, at New Haven, at Ithaca, and at Cranberry Lake in the Adirondack Mountains.

[1] Moore, Barrington, Herbert M. Richards, H. A. Gleason, and A. B. Stout. Hemlock and its environment. I. Field records. Bull. N. Y. Bot. Gard. 12: 325–350. 1924.

Many conditions affect the life of a tree. Some of them act directly on the large trees, affecting their rate of growth or their seed production. Others are more important in their effect on the seedling trees or saplings, and many of the latter are controlled or modified by the mature trees. The established trees regulate the depth of shade, better expressed probably as the intensity of the light. By reducing the wind beneath them and preventing direct access of sunlight, they affect to a small extent the atmospheric humidity and to a much larger degree the rate of evaporation of water, both from the ground and from the leaves of the smaller plants. By their fallen leaves and twigs, gradually decomposing into humus, they change the nature of the soil, especially as to its acidity and its capacity for holding water. A considerable part of the rainfall adheres to the leaves and branches of the trees, later evaporating directly without reaching the ground, thereby never becoming available for the use of plants. Many other environmental conditions are also affected by the presence of the mature trees, but these mentioned may be sufficient to show their importance in the regulation or control of the environment.

In every forest there is a constant immigration of seeds of other species of trees not normally growing there. This is particularly true of our hemlock forest, which is of small area and surrounded by a forest of an entirely different type. These seeds grow if they find suitable conditions for their existence, and if they do grow, they may greatly change the appearance of the forest or even replace the hemlocks completely.

The continuous occupation of the land by generation after generation of the same kind of tree is accordingly a precarious matter and depends entirely upon the maintenance of a certain general standard of environment. There must be sufficient production of seeds to furnish new hemlocks for the forest of the future, and conditions beneath the present mature trees must be better suited, on the average, to the germination of hemlock seeds and the growth of hemlock seedlings than of any other species.

The problem of the committee, therefore, was to determine what the environment of the hemlock is, under which it has successfully maintained itself in the past. The continuance of these conditions in the future, in a much-visited botanical garden

and in the midst of a dense and rapidly growing urban community, may depend on the practical application of the scientific results of this investigation.

Certain features of the problem are best handled by experimental methods in the laboratory or test garden. Among these are the physiological conditions for the germination and growth of hemlock seeds, the nature and importance of the microscopic fauna and flora of the soil in their relation to hemlock, and the optimum conditions of soil moisture and temperature for hemlock. Study of these and similar factors is at present in progress or planned for the future.

For the summer of 1923 the field observations of the committee and the coöperating institutions were confined to the determination of air and soil temperatures, rainfall, and evaporation. Temperatures were taken by standard maximum and minimum registering thermometers, in the air, and in the soil at depths of six and eighteen inches. Rainfall was measured by the usual rain-gauges. Evaporation was measured by Livingston atmometers, giving the rate of water-loss from the surface of a porous clay bulb. Both white and black bulbs were used, since the latter absorbs a larger proportion of heat rays, and by comparison with the white bulb, gives an idea of the effect of solar radiation.

Four stations, similarly equipped, were established at the Botanical Garden, within the hemlock forest, in the adjacent hardwood forest, on the boundary between the two types, and the fourth in the open to serve as a check. The two stations at New Haven were both located under hemlocks, one on a north slope, the other on top of a ridge. The two at Ithaca were in hemlocks and in hardwoods, while the single station at Cranberry Lake was in a hemlock forest. Observations at the nine stations were continued through the growing season of 1923.

The results of this extensive series of observations, which are presented and discussed in detail in the bulletin cited, show numerous interesting points of similarity between the various stations, notwithstanding their distance apart and the consequent variation in climate.

The amount of rainfall varies greatly, of course, from one region to another. In these observations it was found to be regularly less in the hemlocks than in adjacent hardwoods or

in the open. This is due to interception of the rain by the leave and branches, and the amount so intercepted varies from 48% at New Haven to 31% at Ithaca, but at New York amounte to only 9%. The air temperatures show similar variations depending on the latitude, but in general the hemlock fores shows a slightly higher average maximum and a slightly lowe average minimum than the hardwoods. It is interesting t note that the difference in mean temperature between New York the warmest station, and Cranberry Lake, the coldest, is only 12 degrees, and that these represent probably nearly or quite the extremes of mean temperature at which hemlock can exist in pure stand.

The soil temperatures were regularly slightly lower under hemlocks than under hardwoods, both at six and eighteen inches of depth, but in both types of forest are decidedly lower than in the open, where the full effect of the sun is felt.

The rate of evaporation, as measured by the white-bulb atmometers, is higher at New York under hemlocks than under hardwoods, the difference amounting to as much as 27%. At Ithaca, the only other station where similar comparisons were possible, the two rates were the same. More interesting and probably much more important, is the fact that evaporation under hemlocks at all stations, in spite of their distance and variation in climate, is strikingly similar. That at the two New Haven stations was 2% and 16%, that at Ithaca 3%, and that at Cranberry Lake, in a distinctly colder climate, 38% lower than the rate measured at New York. Excepting the Cranberry Lake station, there is more difference in evaporation between the hemlocks and the hardwoods at New York, a hundred yards apart, than between any of the widely removed hemlock stations.

The environmental differences between the hemlock and the hardwood forest at New York, although measurable, do not appear to be sufficient in degree to account for the distinctness of the two types. The committee concludes that it will be necessary to look elsewhere for the cause of the difference, and suggests that soil conditions offer the most promising point of attack.

H. A. GLEASON.

THE 1924 DAHLIA SEASON

(WITH PLATE 300)

A brief notice of the 1924 dahlia collection, written in August, appeared in the September issue of the *Journal*. By way of completion, it may now be added that, in spite of stem-borers, a deficient rainfall in July and October, and a destructive wind and rain storm on the last day of September, the display of dahlias was unusually good and attracted an unusually large number of visitors. Dahlia-growers in the vicinity of New York and some from more distant parts of the country appear to be getting the habit of coming to Bronx Park to keep in touch with the newer and more desirable varieties and to see the flowers growing "on the bush," from which they may gain a more adequate conception of a variety than from reading a description of it in a catalogue or from seeing a cut flower in a show. The collection also helps both amateurs and experienced connoisseurs to replace older varieties with newer ones that may be similar but better. And, more than all, it has opened the eyes of many, unfamiliar with the modern development of the dahlia, to the beauties of its individual flowers and to the possibilities of using it effectively in mass plantings. The orange bed, with the short free-flowering cactus variety Sherlock in front, supported behind by the handsome and profuse decorative Capt. John and the golden-orange Sagamore, and backed up in the rear by the taller Jean Chazot, The U.S.A., and Myra Valentine, was an especially effective combination.

At the north end, the orange bed graded off into the pink, mallow, old-rose, and lavender-pink tones and here the conspicuous and more free-flowering kinds were Francis Lobdell, Countess of Lonsdale, Siskiyou, Jersey's Jewel, Jersey's Rose, Mrs. I. de Ver Warner, George Walters, Mariposa, Virginia Harsh, Nibelungenhort, Esther R. Holmes, and Mrs. Josiah T. Marean.

The new all-scarlet bed was not so successful, owing to various causes, but another season is coming and with it the ever-recurrent hope of better things. This year's experience indicates that for mass effects of scarlet the variety Breeze Lawn will occupy the front rows, while the taller newer hybrid cactus variety Josephine Mendillo will make up the background.

In the main border, where little attention was given to color

grouping, some of the more outstanding among the newer varieties were

Yellow, orange, or copper-colored: Ambassador, Sunny South, California Beauty, El Dorado, E. D. Adams, Tillamook, La Crescenta, Betty, Eastern Star, Elberon Beauty, Laddie, and Clara Finger.

Pink, rose, or lavender-pink: Elsie Daniels, Mr. Crowley, May Blumer, Emma Marie, Wizard of Oz, Margaret Masson, Bertha Jost, Dorothy Durnbaugh, Canteen, Joan of Arc, Patapsco, California Enchantress, Daddy Butler, Pride of Connecticut, Maid of the Mist, Mrs. W. H. Waite, and Junior.

Red: Josephine Mendillo, Marion McCreedy, and T. A. Leonard.

Dark-red, red-purple, garnet, or mahogany: Merrick, Edith Slocombe, Old Black Joe, Ebenezer, Pride of Dahliadel, Senorita, and E. T. Bedford.

Bicolored: President Wilson (crimson, tipped white), Mrs. F. T. Street (dark red, tipped white), Earle Williams (scarlet, tipped white), Nobilis (white and scarlet), Islam Patrol (dark scarlet, gold-tipped), Mary Curtin (red, tipped white), Our Country (violet-purple, tipped white), Biltmore (carmine and white), Senator S. C. Doty (yellow, white-tipped), Carmencita (yellow, streaked with red), and Ben Wilson (red, gold-tipped).

White: Charity Slocombe, Snowdrift, Deadlock, and Pearl White.

Some of the plants, especially those in the border south of the railway station plaza, were more or less damaged by frost on the morning of October 18. A more serious frost on the morning of October 23 injured most of the plants, exceptions being certain red-flowered varieties and others located at the north end of the main border. The roots were dug on November 15 without waiting for a final freeze-up of all the plants, which would have occurred two days later, when the thermometer registered 18° F. If the more or less colorful hang-over after October 23 is included as a part of the dahlia season, this season has been the longest in the seven years' history of the Garden's special dahlia collection. In 1918, the first killing frost was on November 7; in 1919, on November 10; in 1920, on November 13; in 1921, on October 26; in 1922, on October 21; in 1923, on November 2.

MARSHALL A. HOWE.

BERTRAND H. FARR

Bertrand H. Farr died at his home in Wyomissing, Pa., on October 11th, only a few days after a sudden apoplectic stroke and only three days preceding his sixty-first birthday. Death has thus removed a leader in the field of American floriculture; one whose work and accomplishments have been conspicuously noteworthy.

Mr. Farr was born in Vermont. At an early age he moved with his parents first to Wisconsin and then into Iowa. He attended public schools in Iowa and at the age of twenty went to Boston, Mass., where he studied music for several years. Thereafter for a period of about twenty years he was engaged in business, chiefly that of selling musical instruments. It was this work that at last took him to Reading, Pa., and led to his having a home at Wyomissing.

It is said that when Mr. Farr was a small boy his aunt gave him a peony root which he planted and cared for and that its flowers inspired in him the love for flowers that was so strongly developed in later years. While a student of music in Boston, he spent many hours among the plants of the Hovey gardens. Throughout the years of conducting a music store, flower-growing was his hobby, until in 1910 this hobby became his business and he was happy. This was but a natural development. First his home-garden collection of flowering plants spread over vacant lots until several acres were under cultivation. Then a farm was purchased and the Wyomissing Nurseries Company was established. At the time of Mr. Farr's death the nursery was being removed to a still larger farm nearby. The business had been incorporated and will now be continued by those who were associated with him.

Mr. Farr was widely known as an authority on the peony and the iris. His own collections of these plants were most complete, about thirty acres of land being taken for the irises alone. In his breeding of the iris, several thousand seedlings have been grown, but of these only 36 were considered by him as sufficiently good to be offered for sale in his catalogue of this year. For eight years Mr. Farr was president of the American Peony Society and spent much time at the trial gardens of the Society in the difficult work of systematizing the names of the nearly 3000 varieties.

Mr. Farr has been a frequent visitor at The New York Botanical Garden. He was much interested in all our collections of hardy flowering plants and he gave freely of such plants as the bearded and the Japanese irises to increase the collections and make them more complete. He supplied a complete set of the various day lilies (*Hemerocallis*) in cultivation for use in the breeding work now under way in our experimental plots. Last summer he inspected the numerous seedlings that were in bloom and arranged to name and distribute some of the best of these.

Perhaps no better statement of the life work and the ambitions of Mr. Farr can be given than that which he himself wrote in the foreword of the firm's catalogue for the present year. His words are, in part, as follows:—

"The title, 'Better Plants—by Farr,' that I have adopted as my business slogan, may impress some, at first, as an egotistical assertion. I do not mean it in that sense; rather it presents an ideal toward which all of us are striving, myself and the faithful associates who have grown and developed with the business here, and who, by their conscientious efforts, have helped me to the success so far achieved. We always tried to do our best, but it is not enough.

"To you, my friends and patrons, I again extend my thanks for allowing me to share with you the joy of gardening. I repeat that, to me, it means life in the fullest sense, and if I can be instrumental in adding ever so little to the beauty and happiness of the world, I feel that life is worth while."

These closing words of the introduction to the last general catalogue which Mr. Farr issued may well be taken as his last personal message to all lovers of flowers. They may well linger in the memories of his friends as expressing the ambition which ruled the life of Bertrand H. Farr.

A. B. Stout.

THE NARCISSUS COLLECTION

Through the continued interest of the Dutch Bulb Exporters' Association and Mrs. Wheeler H. Peckham, of the Advisory Council, the Garden now possesses a permanent daffodil collection. The Association replaced last year's magnificent gift

of 80,000 tulips with 37,000 daffodils, these to be used as a foundation for semi-natural planting of permanent interest.

In addition to these, a collection of 10,000 bulbs was selected by Mrs. Peckham, for naturalizing and for the display section; these were purchased from John Scheepers, Inc., and Chester J. Hunt by means of a new Narcissus Fund of $365.00 generously supplied by Mr. H. F. du Pont, Miss Irma B. Levy, Morristown Garden Club, Mrs. Charles W. Pratt, New Canaan Garden Club, Hastings Garden Club, Mrs. Herbert S. Greims, Larchmont Garden Club, Mrs. Elizabeth G. Britton, Mrs. Theron G. Strong, Mrs. Wheeler H. Peckham, The Mount Vernon Garden Club, The Garden-Lovers Club, Mrs. H. R. Mallory, The Stamford Garden Club, and North Country Garden Club.

FIGURE 5. Preparations for Narcissus planting, October, 1924. Photograph by Mrs. Wheeler H. Peckham.

Under Mrs. Peckham's personal supervision the bulbs were placed, the October weather permitting practically continuous work. The old mass planting of trumpet daffodils against the rocky hill south of the Horticultural Grounds was increased, and around the whole a narrow band of some 130 varieties planted, making an excellent start towards a complete collection of labeled sorts. Between these and the Iris Plantations thousands of

daffodils were naturalized in the grass. For this purpose, the English bulb-planter was used by Mrs. Peckham, and some dozen other methods for getting the bulbs securely under the sod were experimented with.

The resulting display for next spring is eagerly awaited.

KENNETH R. BOYNTON.

PUBLIC LECTURES DURING DECEMBER

Free lectures and demonstrations were given in the Central Display Greenhouse of Conservatory Range 2 at three o'clock on Saturday afternoons as follows:

Dec. 6. "Fruits and Seeds in Winter." Dr. H. A. Gleason.
Dec. 13. "Rubber Plants. Dr. A. B. Stout.
Dec. 20. "Greenhouse Pests." Dr. F. J. Seaver.
Dec. 27. "A Study of Birds and their Nests." Mr. R. S. Williams.

NOTES, NEWS, AND COMMENT

Dr. C. H. Kauffman, of the University of Michigan, spent several days at The New York Botanical Garden in the latter part of November, continuing his studies on certain of the higher fungi preparatory to a monograph of this group.

At the November Conference of the scientific staff and registered students of the Garden, Dr. H. A. Gleason presented a very interesting account of his summer's work in England, a summary of which was printed in the November issue of the Garden *Journal*.

Mr. Rafael Toro, from the Porto Rico Agricultural Experiment Station, was recently at the Garden for a few days in connection with the study of the Pyrenomycetes of Porto Rico. Mr. Toro is spending a year at Cornell University in mycological work under the direction of Professors Whetzel and Fitzpatrick.

Dr. A. B. Stout and Mr. E. J. Schreiner spent a week in northern Maine during October and another during November in northern New York in work on poplar investigation in which the Garden is coöperating with the Oxford Paper Company.

On the last of these trips, Dr. Stout gave two addresses at Syracuse University, one before the Faculty Club and one to the Plant Science Club on subjects relating to sterility in plants.

The driveway system of the Garden has been greatly improved by the completion during the summer, by the Park Department, of the portion running east and north from the Rose Garden, opened for driving on August 19th, and by the subsequent closing of the narrow and dangerous road which ran past the ruined Lorillard Mansion, this old road now becoming a path, requiring only some narrowing and other modifications. A fatal accident occurred on the old road several years ago and there have been several other accidents. Its closing has relieved apprehension; it will make a beautiful path passing close to many fine oaks in the Arboretum.

The recent appearance of the wonderful book entitled "Timbers of Tropical America," written by Samuel J. Record, Professor of Forest Products in Yale University, and Clayton D. Mell, Tropical Forester, and published by the Yale University Press on the Amasa Stone Mather Memorial Publication Fund, marks an epoch in the study of the woods of tropical trees. Both authors have made occasional visits to The New York Botanical Garden for the purpose of studying specimens and consulting literature, and they have added many valuable specimens to our collections; it is with great appreciation of their work that a copy of their book, given by them, has been added to our library. It is a volume of 610 pages, with many illustrations, the part on the tropical American countries and their forests by Mr. Mell, that on the trees and their woods by Professor Record.

Meteorology for November. The total precipitation for the month was 2.48 inches, traces of which fell as snow; all the precipitation, except slight traces, fell during the last third of the month. The maximum temperatures recorded for each week were *73.5° on the 2d*, 69° on the 7th, 65.5 on the 12th, 59° on the 22d and 52° on the 24th. The minimum temperatures were 34° on the 9th, 31° on the 16th, *17° on the 19th* and 23° on the 30th. The first ice of the autumn formed across the middle and upper lakes on the morning of the 18th.

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A **museum**, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An **herbarium,** comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

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THE PINETUM, THE COLLECTION OF EVERGREEN TREES[1]

The Pinetum, the collection of pines and other cone-bearing trees, is planted, for the most part, on the hills and slopes in the southwestern part of The New York Botanical Garden, Bronx Park, surrounding the great greenhouses of Conservatory Range No. 1, to which these trees give an evergreen setting. Some species occupy other situations, selected for one reason or another, such as taking advantage of forest borders as protection from cold winds, or of soil conditions.

The total number of different species and named varieties represented in this collection is about 230; under glass, mostly in the Central Display Greenhouse at Conservatory Range No. 2, there are 40 other species and varieties, not hardy here, and in the nurseries and propagating houses, young plants raised from seed in recent years, or given by Mr. Childs Frick from his fine *Pinetum Claytonense* at Roslyn, Long Island, we have 14 other kinds, making a total of 284 species and varieties represented. A large part of the main collection was given to the Garden by the late Mr. Lowell M. Palmer, from his estate at Stamford, Connecticut, during the years 1907 to 1911. Many of these trees have now attained considerable size and have formed perfect and elegant specimens. Additions have been made from time to time by the

[1] Abstract of a lecture given at The New York Botanical Garden on Saturday afternoon, November 22, 1924. After the lecture Dr. Britton escorted his auditors through the collection, pointing out features of interest.

income of the John Innes Kane Memorial Fund and by the aid of many friends.

The pines are mostly on the hills and slopes east and northeast of the great greenhouse, the firs and spruces on the slopes north and west; the junipers, red-cedars, arbor vitaes, and retinisporas along and between the two driveways to the south and southwest; the white cedar finds a congenial home near the water-lily lake east of the museum building, where its roots reach down into wet soil; there is a fine group of the Japanese cedar along a forest border at the northern end of the valley of the herbaceous grounds and near this the umbrella pine, also of Japan. On a gentle slope farther south and on the western side of this valley, there is a wonderfully elegant series of yews and their immediate relatives. In a swale near the Southern Boulevard entrance the two kinds of bald cypress may be studied. The Ginkgo or Maiden-hair tree, not a tree conifer but related botanically, occupies a ridge near this entrance and there is also a row of fine trees at the Mosholu Parkway Entrance.

Besides the pinetum proper, evergreen conifers have been planted in masses at several places, such as in forming backgrounds for the flower gardens at Conservatory Range No. 1; at the western end of the Long Bridge; at the Woodlawn Road Entrance; at the Rose Garden; near the Rock Garden, where there is also a war-memorial grove of Douglas Spruce. In coöperation with the New York State Conservation Commission, two long bare and rocky ridges south of the Rock Garden have been planted, the one with white pine, the other with red pine, the young trees now nearly covering them.

No account of evergreen conifers in The New York Botanical Garden would be complete without mention of the famous hemlock grove on the hills along the Bronx River. Recent studies of this forest and its reproduction led to a counting by one of the gardeners, of the hemlock trees, last year, through which it was ascertained that there are over 3,600 of them, large and small, seedlings not included. As the most southern hemlock forest along the Atlantic Coast it has a special interest; it was once characterized, indeed, by the late Mr. William E. Dodge, as the most precious natural possession of the City of New York.

The systematically planted pinetum includes about 1,400 individual trees; approximately 800 have been used in the several

massed plantations; the white pine, red pine, and war-memorial Douglas Spruce plantations include about 2,100 trees; in the greenhouses there are about 50 more, making the total number of cone-bearing trees, large and small, within the Garden reservation at the present time not fewer than 7,950, seedlings not included.

N. L. Britton.

THE GEOLOGY OF THE NEW YORK BOTANICAL GARDEN[1]

The lecturer remarked that what he proposed to say might best be designated as " a talk on certain geologic features of The New York Botanical Garden." To discuss adequately all of the geological features of the Garden would be impossible in the limited time at his disposal.

The geological strata exposed within the limits of the Garden include a basal series of certain of the oldest crystalline rocks on the North American continent, and, immediately overlying these, recent surficial deposits of clay, sand, gravel, and bowlders. Between these ancient crystalline rocks and the recent incoherent surface deposits, representing a time interval of tens of millions of years, the geological records are missing. Whatever deposits may have been laid down, whatever rock strata may have been formed here during that time, have been entirely eroded away.

Of the crystalline rocks there are three generally recognized formations represented within the Garden area. These are, in the ascending order of sequence:

3. Manhattan schist.
2. Inwood limestone or dolomite.
1. Fordham gneiss.

They are all what are known as metamorphic rocks, that is, rocks that have been changed, or metamorphosed, from their original condition into a condition that is entirely different, by the action of heat, moisture, and pressure, exerted through a vast period of time. All were originally sedimentary rocks sandstones, shales

[1] Abstract of a lecture given at The New York Botanical Garden on Saturday afternoon, November 29, 1924. After the lecture Dr. Hollick piloted his auditors to points of geologic interest in the Garden and explained the significance of the features examined.

and limestones—derived from the wear and tear of still older rocks, of which we have no records, and from deep water, oceanic deposits.

This region was, of course, under water at the time when these sedimentary rocks were originally laid down. Subsequently there ensued a long period of stress and strain, while the earth's crust was slowly adjusting itself to changing conditions. The sedimentary strata were squeezed, laterally compressed, and thrown into folds. Dikes and veins of molten granite were intruded, sometimes cutting across the bedding planes, sometimes following along between them. Thermal water, containing quartz and other minerals in solution, permeated them. The original mineral constituents formed new combinations under the influence of the heat and moisture. The sandstones and shales were metamorphosed into quartzite, gneiss, and schists, and the limestone into dolomite or magnesian marble.

The Fordham gneiss is probably of Eozoic age. The Inwood limestone and Manhattan schist are probably of early Paleozoic age. The granite intrusions represent the latest rock formation of the series.

A period of continental elevation followed. The folded, metamorphosed rocks were raised above sea level, forming ranges of hills and mountains, and erosion began. The elevations were worn down and drainage channels were established. The limestone, being the softest rock, was the first to yield, and this has largely disappeared from the surface elevations, but is represented in many of the depressions where its disintegration caused the establishment of the ancient drainage channels, while the more resistant gneiss and schist remained in the form of rugged hills and ridges of rock.

It is difficult, and in places impossible, to differentiate between the gneiss and the schist, as far as their general appearance, structure, and mineral constituents are concerned. They are largely composed of quartz, mica, and hornblende, with other minerals in varying proportions, and an exposure of limited extent may show any one or another of these minerals in excess or not represented. The Manhattan schist, however, is the prevailing rock of the Garden, and the only place where there appears to be any indication of the Fordham gneiss is in certain exposures near the western

border, along the line of the Harlem Division of the New York Central Railroad. The Inwood limestone is nowhere represented as a surface outcrop within the limits of the Garden. An outcrop was formally exposed, however, at a point near the northwest end of the main conservatory building, but was covered in the process of grading and filling. The abutments of the approach to the elevated railroad, however, were constructed of rock quarried from this outcrop, and there the lithological and mineralogical characters of the rock may be seen and examined.

A long hiatus in the known geological history of the region must here intervene. We know that there was a long period of elevation, followed by several periods of depression and reëlevation, during which there was deposition and erosion; but no records remain of these ups and downs of the land, until the changes came that preceded and were coincident with the Glacial Epoch of the Quaternary Period, when the great continental glacier, advancing steadily and irresistibly southward from the Canadian highlands, not only swept the rock floor of this region clean but also eroded the rock itself and left its records in the smoothed and rounded outcrops, the grooves and scratches on the surface exposures, and the erratic bowlders that remained stranded when the ice melted. Examples of these phenomena may be seen almost everywhere throughout the Garden. The compass direction of the scratches bear about north 12 degrees west. The ice, therefore, must have crossed the valley of the Hudson River in its advance on this region, and, if additional evidence were required, it may be seen in the bowlders of diabase that were evidently torn from the Palisades and left stranded here. Several times the ice advanced and retreated, until it finally receded and disappeared. Coincident with it, and especially during the periods of melting, torrential streams of water came from it, and these transported sand, gravel, and bowlders that did their part in still further eroding and sculpturing the rock surfaces. The ice and its accompanying debris, and the streams and their accompanying sands and gravels, when checked in their flow, deposited the material they were transporting, and this often resulted in the formation of dams that blocked old drainage channels and diverted the streams into new ones. Something of this kind evidently happened to the Bronx River, which originally occupied

the old eroded limestone valley adjoining the northwest border of the Garden, along which the N. Y. Central Railroad is located. It may be seen to occupy the west side of this valley to as far down as a short distance below Williamsbridge, where, instead of continuing on in a straight course, it turns toward the east and abandons its old course entirely. It was diverted permanently by some obstruction which it could not surmount and proceeded to carve out new channels through the ridge of schist that extended across its course. The velocity of the current was impeded and the water dropped most of its load of sand and gravel in the impounded water to the north of the ridge. This material is what forms the flood plain on which the Fruticetum collection is planted. Doubtless the water flowed through several outlets when it was at its flood, but eventually, when the flow became less, only one outlet was necessary, and this developed into the gorge through which the present stream runs.

Proof of the former flow of the water over the highest parts of the ridge may be seen in the location of pot holes in the rock, and in other evidences of water erosion.

The lecture was illustrated by maps, diagrams of geological sections, and by specimens of the characteristic rocks, cobblestones, and pebbles that showed the difference in appearance between those that were transported by water and those that were transported by ice.

ARTHUR HOLLICK.

SHADE TREES, THE COMPANIONS OF MAN[1]

The love of trees belongs among universals and perennials. The relation between it and man is an obscure and fascinating mystery. Can any wise man make even a beginning toward explaining the relation between a pine tree and a soul? Yet the one speaks to and affects the other. Make it into a violin and in

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, September 20, 1924. Mr. Carl Bannwart, the lecturer, is the Superintendent of Parks of Newark, New Jersey. He has been described as the "Archbishop of the Green Diocese" of 65,000 trees upon that city's streets. Thirty-five thousand of these trees were set out within the last twenty years under his supervision.

the hands of Fritz Kreisler and Mischa Elman a cry comes out of it which is little short of human, thrilling spirit as well as nerves with inevitable emotion. Although the spell cast by trees evades analysis, no one can regard it as a fiction of the fancy of a few mooning hyperesthetes. It casts its subtle witchery wherever leafy branches cast their shade. Rousseau, the French painter, said, "The tree which rustles is for me a grand history. If I can speak with its language, I shall have spoken the language of all time."

Nor is this companionship hard to explain—when you think of the similitude to human life exemplified by the tree. They feed on the same elements but have the capacity to create the starches and sugars out of the earth; they move, they carry burdens, they are migratory; they are born to conflict—some in the open with the elements, some in forests with brethren and enemies; they are subject to the diseases of infancy and maturity and to death. In their growth and struggles, their failures and successes, they appeal to the heart of man.

The cordial trees everywhere extend a sympathetic invitation to take refuge with them, as do the wild goats with the high hills and the conies with the rocks! James Russell Lowell advises that every man should sometimes retreat into the heart of the woods and closet himself in a rustling privacy of leaves, where one may find a peaceful pleasure and respite from nagging necessities, throw the pack of pestering plagues which pursue him off his scent by taking to the many-scented woods. Escape from din and glare into their leafy quietness pacifies irritated nerves and promotes a Christian temper, "Their tempered light is like a perpetual morning before sunrise, and is stimulating and heroic. The anciently reported spells of those places creep on us. The communicative trees begin to persuade us to live with them and quit our life of solemn trifles."

Genuine acquaintance with the trees reacts upon the nature-lover's soul with startling effect. What man is so base and sordid that he can contemplate the beauties of an autumn wood without feeling some measure of uplift and ennoblement? What blind eye is so filmed with materialism that it can watch a tiny seed develop into tons of solid timber without awe and wonder in the presence of the power of that tiny seed. What a thought of God was that when He first thought of a tree!

> . . . "Nature never did betray
> The heart that loved her: 'tis her privilege
> Through all the years of this our life to lead
> From joy to joy."

It is not preposterously fantastical to say that the tree is a *breathing* creature, not drawing the air into internal lungs, but spreading its leaf-lungs abroad upon the air in order that the fluid circulating through a million veins from rootlets to topmost twig-tips may be vitalized by exposure to chemical atmospheric action; a *bibulous* creature, boring for water and sending its thirsty roots abroad in all directions to get a drink; a *sensitive,* expressive and responsive creature, whispering, sighing, murmuring, shivering, writhing, gesticulating with its limbs, and bleeding when it is hurt. Some vaguely felt resemblance is intimated also by the fact that many literatures make trees emblematical of men, from the Old Testament likening the man who delights in the law of the Lord to a tree planted by the rivers of water that bringeth forth fruit in its season, and declaring that the righteous shall flourish like the palm tree and grow like a cedar in Lebanon, down to John Muir, the geologist and botanist of the Yosemite, when he figured the lofty mind of the Sage of Concord with the hyperbole, "Emerson is the Sequoia of the human race."

At times one suspects a sort of semi-human *difference* of *disposition* among trees. Some behave sociably and others with reserve. Some gather in groups or fraternize in forests, interlocking friendly arms as if fond of fellowship and converse; as Henley says,

> "Each to the other bending, beckoning, signing,
> As in some monstrous market place
> They pass the news, these Gossips of the Prime,
> In that old speech their forefathers
> Learned upon the lawns of Eden, ere they heard
> The troubled voice of Eve
> Naming the wondering folk of Paradise."

Others like to stand apart as if possessed of dainty and exclusive instincts, no gossips, but given to pensive meditation. Of those that cultivate reserve and independence the elm is first. Sometimes it seems to say, "Let me have an occasion all to myself; give me entire possession of a field and see me fill it." And, behold, that one tree suffices to decorate the field from center to outer edge.

At times and in a way trees have been *teachers* of mankind. By rooted abiding in their appointed places they admonish vagabonds and inculcate stability. Vagrant Louis Stevenson hints at advantages forfeited by the gypsily inclined: "He who can sit squarest on a three-legged stool, he it is who has the wealth and the glory." As by continuity of growth in a fixed place the tree gains height, girth, and celebrity, so man by becoming through honorable years, an old resident, added to whatever other standing he may have a peculiar prestige. Sidney Lanier wrote of the Cedarcroft Chestnut on Bayard Taylor's place:

> "The worth and sum of all his centuries
> Suffused his mighty shadow on the grass."

That the sensitive imagination of poets should be enamored of such a living wonder as the tree was from the first and forever inevitable. Witness of this is borne in English as in earlier languages. Old Chaucer wove the woodland in his measures; Spenser sent his heavenly maid moving amid the forests; Milton tuned his deep diapason to the groves, and owned that cathedral organs give forth no music grander than that which sounds when a forest of pines awakes at midnight to chant a solemn psalm of praise; tall oaks awed Keats into calling them "those green-robed senators of mighty woods"; Wordsworth wandered pensive in leafy shade and rounded an oak in Rydal Mount into a sonnet; Tennyson confided his secret of love to the talking oak of Sumner Chase; and out of meditation in Dulwich Woods Browning brought his limpid-souled Pippa to sing her sweet saving songs forever in the startled ear of the world's wickedness.

"I often think when working over my plants," said John Fiske, "of what Linnaeus once said of the unfolding of a blossom. 'I saw God in His glory passing near me, and bowed my head in worship.'"

"Through every blade of grass," says Carlyle, "the glory of the present God still beams."

Amid the many marvels and splendors of the world few surpass the entrancing spectacle which the Great Artist sometimes makes of a single tree, and literature and life are full of the exquisite response of the human spirit to such spectacles. Dorothy Wordsworth's journal pictures one: "As we went along we were stopped at once, at a distance of perhaps fifty yards from our

favorite birch tree. It was yielding to a gust of wind, with all its tender twigs; the sun shone upon it, and it glanced in the wind like a flying sunshiny shower. It was a tree in shape with stem and branches but it was like a spirit of water." Emily Dickinson wrote to Colonel Higginson: "I think you would like the chestnut tree I passed in my walk. It hit my notice suddenly and I thought the skies were in bloom."

Very early in the life of our race the tree struck deep roots in the reverences and superstitions of men. Towering aloft between man and the sky, its strength and grace, its stir and animation, its beauty and beneficence charmed him to admire and often subdued him to worship. In many places and times it has stood associated with the sacred and the superhuman. Indications of tree worship are found among relics of prehistoric forest races as well as in the rites of later and even modern polytheistic idolatries. The earliest superstition vaguely conceived of the tree as of itself a wonderful living being; the thought advanced to the conception of a tree spirit, like the Greek dryads or tree nymphs confined within or near the tree, and possessing power to command rain or to cause fertility in plants or animals. . . .

The Samoan chief said to the missionary when asked as to his idea of a deity, "We know that at night some one goes by amongst the trees, but we never speak of it."

The lantern-slide illustrations included copies of paintings by Claude Lorrain, Corot, Blakelock, Rousseau, all of them supreme tree painters; the Dodonnean Oak, the Heglick tree, the late Charter Oak at Hartford; the Giant Cypress at Tule, Oaxaca, Mexico; Shakespeare's, Milton's, Luther's, Gladstone's, Buddha's, Jeanne d'Arc's, Washington's, Holmes's, Emerson's, Lowell's, Bryant's trees; Sidney Lanier's Live Oaks; celebrated trees in history, architecture, painting, and sculpture.

CARL BANNWART.

FUNGI AND INSECTS[1]

On July 26, a "running lecture" or out-of-door demonstration of the work of destructive insects and fungi was given. Leaving the Museum Building at 4:00 o'clock, the first stop was

[1] A brief report of one of the "Walks and Talks in The New York Botanical Garden," on July 26, 1924.

made under the tulip trees in front of the building and attention called to the tulip-tree aphid, green fly, or plant louse which secures its nourishment by sucking the juices from the leaves, excreting a sweetish "honey dew" which falls in a fine mist from the trees. Some of the natural enemies of the aphid were also noted, especially the "lady bird" beetle, which feeds upon the destructive green fly and helps to keep the numbers down.

The work of the European leopard moth was next encountered in the maple and basswood trees. The caterpillar of this insect, which is about two inches long when mature, bores into the larger branches, causing them to decay and so weakening them that they finally break and fall. This insect is often responsible for the breaking, without any apparent cause, of the branches in mild wind-storms.

One of the most destructive insects at this particular time is the bag worm, an omnivorous feeder, attacking both deciduous and evergreen trees of all kinds. The caterpillar of this insect builds for itself a house and carries the house with it, merely protruding its head while feeding and tying the house on while resting inside. This house or bag, which is made of silk and bits of leaves, is so tough that it is difficult for the birds to destroy the worm within. Orchard orioles, however, have been observed persistently pecking at these bags until the grub has been removed through the small hole at the tip. The insect is so well camouflaged that great damage can be done by it before its presence is detected, especially in the case of evergreens.

Reference was made to the "tent caterpillar" which has caused an unusual amount of damage during the present season. This caterpillar has now completed its destructive work for the season and about this time the egg clusters are being deposited like wads of chewing-gum on the twigs of the wild cherry and related hosts. Since each egg cluster means about two hundred caterpillars next spring their destruction now will help to suppress the insect the coming year.

The destructive work of the European "pine shoot moth" in the young plantation of red pines was the most striking exhibit of the day. Several years ago the same insect attacked the dwarf pines in the Botanical Garden and for a time it looked as though this ornamental would have to be entirely eliminated from our

collections. They were, however, allowed to remain and seem now to have almost entirely recovered from this epidemic. Whether the red pines will likewise eventually throw off this enemy or survive its destructive work remains to be seen.

One of the most recent introductions is the European willow beetle, a very small bluish insect with a bronze luster, which, both in the caterpillar and adult stages, feeds on the leaves of the willows, doing to them what the elm-leaf beetle has done for the elm leaves a few years back. Just what the future of this insect will be we can not say.

In all, about a score of insects and fungi were examined and their pernicious habits described or the evidences of their destructive work reviewed. To check all of these plant enemies by artificial means would require more time and money than an institution of this kind could afford to spend, so that we depend largely upon natural enemies for their control, resorting to artificial treatment only in the most severe cases.

FRED J. SEAVER.

EZRA BRAINERD

Dr. Ezra Brainerd, who was president of Middlebury College from 1885 to 1908, died at his home in Middlebury, Vermont, on December 8, nine days before completing his eightieth year. He was a man of versatile mind and varied intellectual interests. Before assuming the presidency of his *alma mater*, he had served there as a professor of rhetoric and English literature and later as a professor of physics. Meanwhile he had been developing an active interest in the geology of the Champlain valley and in the flora of Vermont. He was one of the organizers of the Vermont Botanical Club in 1895 and was its president continuously up to the time of his death. In 1900, in coöperation with L. R. Jones and W. W. Eggleston, he published "The Flora of Vermont, a List of the Fern and Seed Plants growing without cultivation." His subsequent studies on blackberries and violets covered a much wider geographic range, they were based in part on the results of culture in his own garden, and they were widely recognized as authoritative. His "Violets of North America," a monograph of 172 pages and 75 figures, published in 1921, will always remain

a model of its kind in American botanical literature. Dr. Brainerd was a frequent and always welcome visitor to the Botanical Garden. During his later years he had been preparing a treatment of the violets for the *North American Flora* and we are happy to learn that he left a manuscript that will be available for that purpose.

MARSHALL A. HOWE.

RESIGNATION OF DOCTOR MURRILL

Dr. William Alphonso Murrill, who was for twenty years a member of the staff of The New York Botanical Garden, beginning with August, 1904, has severed his connection with the institution. He served as an Assistant Curator from 1904 to 1905; as First Assistant to the Director-in-Chief, 1906 to 1919, during the last eleven years of which he was also Assistant Director; as Supervisor of Public Instruction from 1919 to August 1, 1924. Throughout the period of his service he was in charge of the collection of the larger fungi, which he built up assiduously, and his publications have been numerous. Dr. Murrill played an active and important part in the development of the Garden and his resignation has been accepted with regret.

N. L. BRITTON.

CONFERENCE NOTES FOR DECEMBER

The December Conference of the Scientific Staff and Registered Students of the Garden was held on the afternoon of the third.

Dr. Arthur Hollick spoke on "An Interglacial Flora from Kootenay Valley in British Columbia." The following is a summary of his report.

"About twelve years ago the Canada Geological Survey sent to me, for identification and report, a collection of fossil plants from the Pleistocene (interglacial) deposits of the Kootenay Valley, British Columbia. A report was prepared and transmitted, which was published in the Summary Report of the Survey for the year 1913. About ten genera were identified in the collection,

including *Hicoria, Populus, Alnus, Fagus, Ficus, Ulmus, Coccu-lus, Cissampelos, Platanus,* and *Vitis.* The leaves are so closely similar to certain existing species in these genera that they might be regarded as identical, except for their prevailing larger size. The *Ficus* is represented by well-defined fruiting branches. The large size of the leaves, and the presence of the genus *Ficus* indicates a luxurious, warm-temperate climate.

" Since the first collection was reported upon a second lot was sent. This lot has also been studied, and selected specimens from each collection have been photographed and drawn, and specific descriptions have been written for a paper that is being prepared for publication in the near future. The specimens represent a heretofore undescribed flora, or possibly a distinct regional phase of the Don Valley interglacial flora of Eastern Canada. The stratigraphical correlation of these and other British American interglacial floras has not, however, been attempted."

The remarks were illustrated by specimens of the plant remains, and photographs and drawings of the specimens selected for illustration.

A second report was presented to the Conference by Mr. E. J. Schreiner on " Some Observations on the Growth of Poplars." This was a general summary of studies made during the past year on the rapidity of growth of several wild species of *Populus* and of certain of the varieties in cultivation, the observations being made in coöperation with the Oxford Paper Co. Sections of trees, various photographs, and graphs were exhibited.

A. B. STOUT,
Secretary of the Conference.

PUBLIC LECTURES DURING JANUARY AND FEBRUARY

Free lectures and demonstrations are given in the Central Display Greenhouse of Conservatory Range 2 on Saturday afternoons at 3 P. M., as follows:

Jan. 3. " Christmas Trees from Other Lands." Mr. K. R. Boynton.

Jan. 10. " Ferns of the Tropics." Dr. M. A. Howe.

Jan. 17.	"Illustrations of Rare Plants Grown by the Garden."	Mr. K. R. Boynton.
Jan. 24.	"Some Plants concerned in the Formation of Coal."	Dr. Arthur Hollick.
Jan. 31.	"Variegated Plants."	Dr. A. B. Stout.
Feb. 7.	"Cacti."	Dr. J. K. Small.
Feb. 14.	"House Plants and Their Care."	Mr. H. W. Becker.
Feb. 21.	"Tropical Orchids."	Dr. H. A. Gleason.
Feb. 28.	"The History and Development of Greenhouses."	Dr. J. H. Barnhart.

NOTES, NEWS, AND COMMENT

A valuable collection of flowering plants and ferns from Avnik, Alaska, collected by Mrs. John W. Chapman, has recently been given to the Garden by Dr. Herbert M. Denslow.

A collection of the bulbs of the Cayman spiderlily (*Hymenocallis caymanensis*) has been secured from the Cayman Islands, through the Director of Agriculture for Jamaica, Hon. H. H. Cousins. These are, perhaps, the first bulbs of this species collected since the plant was first named and described. The object in securing them is to determine whether or not our Florida coastal spiderlily is the same as this Cayman plant.

The January Conference of the Scientific Staff and Registered Students of the Garden was held on the afternoon of Wednesday, January 7th. The program consisted of reports on the recent meetings of The American Association for the Advancement of Science and the Botanical Society of America in Washington. Professor Harper and Drs. Gleason, Howe, and Stout participated in the discussion. Dr. Rydberg, who also attended the meetings, had not returned from Washington at that time.

The following botanists registered in the library during the autumn months: Miss Ruth D. Sanderson and Mr. Ivan M. Johnston, Gray Herbarium, Cambridge, Mass.; Prof. Forman T. McLean, Kingston, R. I.; Prof. Wm. F. Langworthy, Colgate University; Messrs. S. H. Burnham, John P. Young and Raphael A. Zon, Ithaca, N. Y.; Mr. George L. Slate, Geneva, N. Y.; Mr.

Eugene A. Rau, Bethlehem, Pa.; Prof. J. B. S. Norton, College Park, Md.; Dr. Neil E. Stevens and Dr. Edgar T. Wherry, Washington, D. C.; Mr. H. G. Macmillan, Greeley, Col.; Profs. E. D. Merrill, N. L. Gardner, and Ernest B. Babcock, Berkeley, Cal.; Prof. Philip A. Munz, Pomona College, Cal.; Prof. Francis E. Lloyd, McGill University, Montreal, Canada; Prof. W. T. MacClement, Queens University, Kingston, Can.; Mr. Fritz Johansen, Ottawa, Can.; Dr. C. H. Ostenfeld, Copenhagen, Denmark; Dr. O. Stapf and Major T. F. Chipp, Royal Botanic Gardens, Kew, England.

The following poem appeared in *The Sun* of November 20, 1924:

THE BOTANICAL GARDEN

Gay from the kisses of the autumn sun
  Mellowing these lambent November days,
Our city's garden would not say farewell,
  But holds her beauty for our rapturous gaze.

Not seasonal flowers alone delight us here,
  Bright though their gold and tawny colors are;
For feathery gypsophila laden with bees,
  Delphiniums blue, pink roses, go far

In making riotous this most lovely place
  Where butterflies yet linger at the heart
Of sweetness, winging from flower to flower,
  Taking their fill ere they and blossoms part.

'Mid vivid bloom the low weeping hemlock
  Sweeps; beneath it scratches a junco bird.
Masses of crimson barberries clustering;
  Pines in green gradations rising skyward.

Suddenly a-down come three scolding crows,
  Actions plain that enemy they see.
Alarmed, from cedar's depth out flies an owl—
  Crows pursue. . . . Can this city garden be?

FRANCES CARRUTH PRINDLE.

Along the lines of the lecture of Professor M. A. Chrysler at The New York Botanical Garden on July 27, 1924, under the title of "Harnessing the Sun: Can Botanists Solve the Motor-fuel Problem?", it is of interest to note some recent remarks of Mr.

Fred R. Low, the retiring President of the American Society of Mechanical Engineers. As quoted by *The New York Times* of December 3, Mr. Low said, in substance:

After explaining that the main dependence for power nowadays is on our fuel supply, and analyzing the processes whereby fuel is capable of producing heat by the attraction between its atoms, mainly those of carbon, hydrogen, and oxygen, Mr. Low proceeded to discuss the possible derivation of power from the sun.

"To separate these elements in the laboratory," he said, "we are obliged to resort to the most powerful chemical agents and to conduct the process in vessels composed of the most refractory materials under all the violent manifestations of light and heat; but in the economy of nature this process is constantly going on, not with the noisy demonstration of prodigious effort, but quietly, in the delicate structure of a green leaf waving in the sunlight.

"In some mysterious manner in the frail and microscopic vegetable cell the energy received from the sun is made to separate these atoms against their mutual attraction--to wind up the clock that has run down. The carbon is built into the structure of the growing plant and the oxygen returned to the atmosphere.

"And it has been by this process that the energy of the sunlight of forgotten ages has been absorbed, built into vegetation and stored in strata of coal and pools of oil to render possible this age of power.

"The earth's surface absorbs from the sun heat energy equivalent to some 3,900 foot-pounds per square foot per minute. Referred to its cross-section, this means that the earth is absorbing energy from the sun at the rate of over 162 trillion horsepower. Most of this energy is immediately radiated back to space. . . .

"When we shall have found the secret of the vegetable cell there may be a possibility of accelerating and intensifying this slow process of Nature [the storing of energy] and of utilizing more directly and immediately than by our roundabout process of accelerating and retarding molecules, a larger proportion of this vast stream of energy that comes to us from the sun."

Meteorology for December.—The total precipitation for the month was 2.55 inches, traces of which fell as snow. The maximum temperatures recorded for each week were 57° on the 6th, *60.5° on the 9th,* 55° on the 17th, and 38.5° on the 24th. The minimum temperatures were 21° on the 5th, 22° on the 14th, 14° on the 21st, and *11° on the 26th.*

Meteorology for the year 1924.—The total precipitation for the year at The New York Botanical Garden was 40.86 inches. This was distributed by months as follows: January, 4.89 inches, in-

cluding 2 inches snow measurement (0.20 inch water); February, 3.12 inches, including 9.5 inches snow measurement; March, 1.21 inches, including 1.5 inches snow measurement; April, 6.02 inches, including 7 inches snow measurement; May, 6.85 inches; June, 2.90 inches; July, 1.77 inches; August, 5.06 inches; September, 3.76 inches; October, 0.25 inch; November, 2.48 inches, including traces of snow; December, 2.55 inches, including traces of snow. The total snowfall for the year was 20 inches, which is figured as equal to 2 inches of rainfall. The maximum temperature for the year was 98° on the 7th of August. The minimum temperature was + 5° on the 27th of January. Light killing frosts occurred on the mornings of the 14th and the 18th of October; but the first general freezing temperature of the autumn was on the morning of the 23rd of October, when 30° was recorded. The latest freezing temperature of the spring was on the morning of the 17th of April, when 32° was recorded.

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MUSEUMS AND HERBARIUM

326 specimens of grasses from Brazil. (Collected by Mr. André Goeldi.)

7 specimens of *Stizolobium*. (By exchange with the Bureau of Plant Industry.)

226 specimens of flowering plants from Mexico. (Collected by Mr. C. A. Purpus.)

244 specimens of flowering plants from French Guiana. (By exchange with the Natural History Museum, Paris.)

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23 specimens of sedges from Brazil. (Collected by Mr. André Goeldi.)

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1 specimen of fungus from Colorado. (By exchange with Professor Ellsworth Bethel.)

2 specimens of fungi from Pennsylvania. (By exchange with Dr. L. O. Overholts.)

1 specimen of *Urnula Craterium* from Ontario. By exchange with Professor John Dearness.)

1 specimen of *Peziza badia* from Pennsylvania. (By exchange with Dr. L. O. Overholts.)

61 specimens of fungi from Illinois. (By exchange with Professor F. L. Stevens.)

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6 specimens of fungi from Hawaii. (Collected by Professor F. L. Stevens.)

2 specimens of fungi from Florida. (By exchange with Mr. G. F. Weber.)

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127 specimens of *Anychia* from Pennsylvania. (Given by Mr. L. W. Nuttall.)

4 specimens of the fruit of *Rhapidophyllum Hystrix* from Florida. (Given by Mr. L. A. Coleman.)

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1 specimen of moss from New York Interstate Park. (Given by Professor E. B. Chamberlain.)

25 specimens, "Musci Acro. Bor. Am." Fasc. 21. (By exchange with Professor J. M. Holzinger.)

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ACCESSIONS

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SELF-INCOMPATIBILITY IN WILD SPECIES OF APPLES

Certain individuals of some of the wild species of apples are self-incompatible and require cross-pollination for the setting of fruit quite as do many of the cultivated clonal varieties of this fruit.

Tests which show this condition were made in the orchards of the State Experiment Station at Geneva, N. Y., during the year 1924. For these tests the bagging method was employed. Branches with several clusters of flowers, all yet in bud, were enclosed in paper bags securely tied at the mouth to prevent entrance of foreign pollen. The bags were left thus for about three weeks, when the paper bags were replaced by bags of netting in case fruit was setting. The period during which the paper bags remained on the branches coincided with that of other pollinations at Geneva in the breeding work with apples. The method of testing is one frequently employed in similar studies and in breeding work with the various fruit plants. With such treatment, the enclosed flowers open fully, shed pollen freely, are evidently well pollinated through the movements of branches and bags in the wind, and when fully self-compatible set fruit abundantly.

A single tree of each of thirteen species and two trees of one species were tested. The specific names here used are those with which the scions from which the trees were grown were labelled when received at Geneva from the Office of Foreign Seed and Plant Introduction, U. S. D. A., or from other sources From three to ten bags were used per tree, with each enclosing

at least several flower clusters and numerous flowers, this varying according to the profusion of bloom.

Of the trees thus tested, one of each of the following species was found to be completely self incompatible and unable to produce any fruit to self- and close-pollination: *Malus coronaria* (152 flowers tested); *M. Ringo* (225 flowers); *M. Ringo sublobata* (212 flowers); *M. pendula* (200 flowers); *M. prunifolia* (187 flowers); *M. prunifolia macrocarpa* (32 flowers); *M. sylvestris* (35 flowers); and *M. orthocarpa* (167 flowers). In all of these cases not a single fruit started to develop to flowers

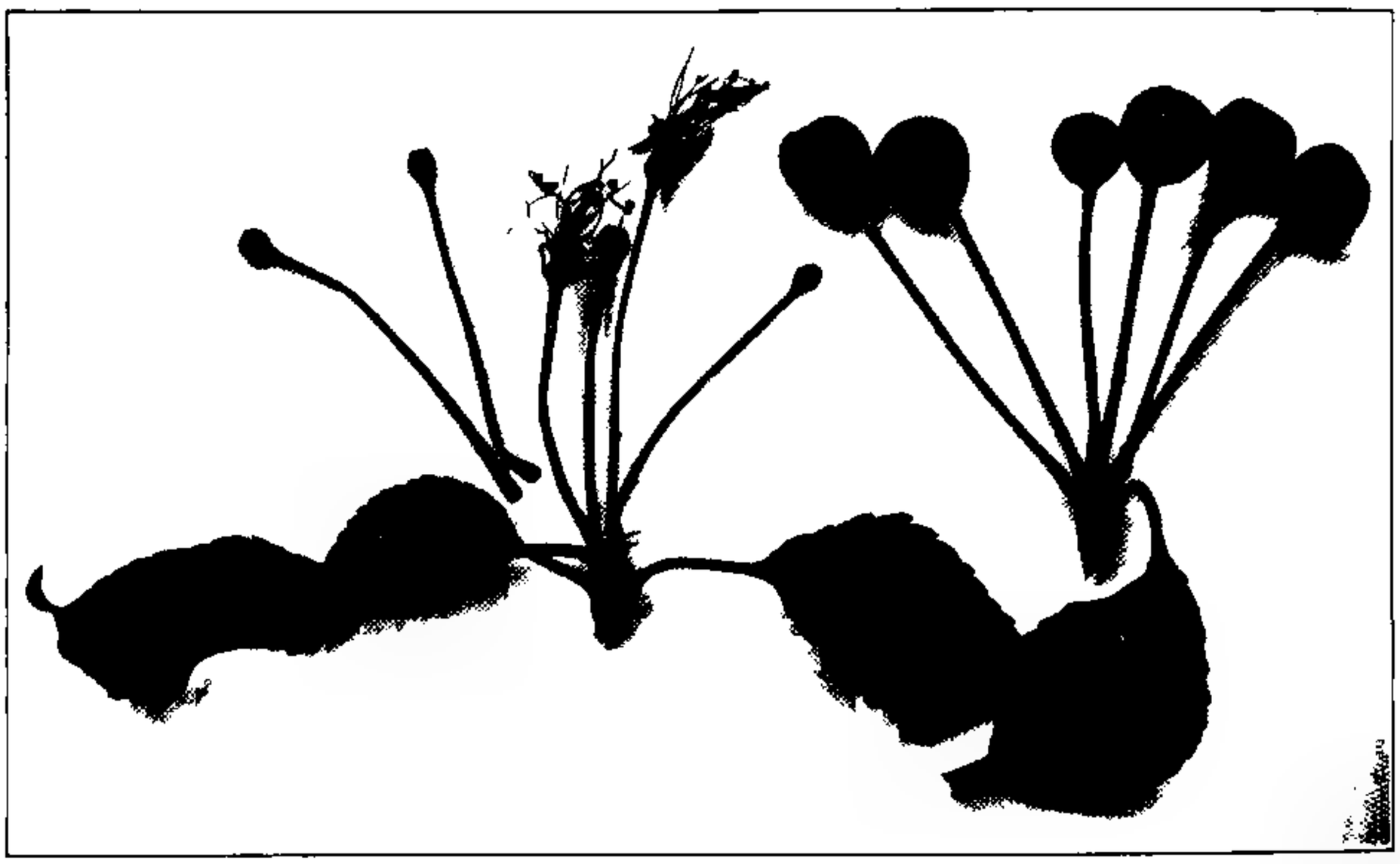

FIGURE 1. Above at the left is a cluster of flowers of *Malus prunifolia* four weeks after self-pollination and at the right is a cluster of fruits from the same branch that developed from cross-pollination. Such results are typical for the kind of sterility common in apples.

submitted to self- and close-pollination only, but each tree produced fruit from flowers subject to open cross-pollination (see figure 1) and on most trees such fruits were abundant.

A tree of each of the following species was highly productive of fruit to the enforced self-pollinations. The number of flowers enclosed per bag and the number of fruits that matured are as follows:

M. Toringo; 49 flowers, 18 fruits; 51 flowers, 31 fruits; 99 flowers, 69 fruits; 131 flowers, 80 fruits.

M. Malus; 25 flowers, 13 fruits; 35 flowers, 18 fruits; 58 flowers, 38 fruits; 60 flowers, 37 fruits (see figure 4).

M. Sargentii; 45 flowers, 39 fruits; 58 flowers, 41 fruits; 60 flowers, 45 fruits; 72 flowers, 57 fruits; 141 flowers, 135 fruits.

These three trees produced fruits in abundance but the proportion of flowers setting fruit and the size of the fruit seemed to be as good for the enclosed branches as for those subject to

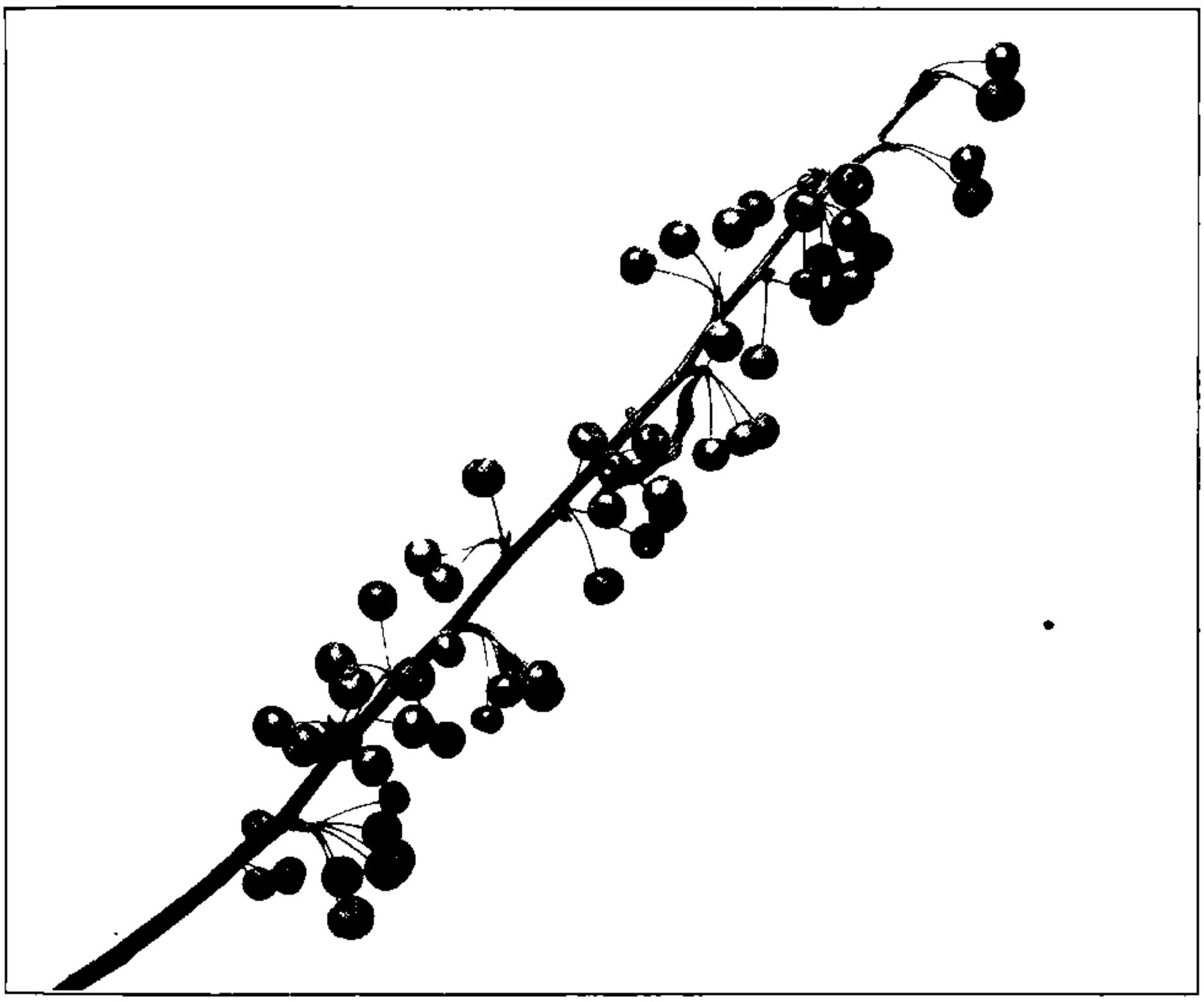

FIGURE 2. Above are shown the mature fruits on a branch of the same tree (see figure 1) subjected to open cross-pollination.

The tree was able to produce fruits in abundance when there was a compatible cross-pollination. Its own pollen is potent but is incompatible in self-fertilization.

open pollination. These plants appeared to be fully self-compatible.

For another group of trees the number of enclosed flowers that set fruit was relatively very low. These plants appeared to be feebly self-compatible. The data for these are as follows·

M. baccata; three bags enclosing 24, 35, and 58 flowers, a total of 117 flowers; in each of two bags one fruit developed, in the other there were two fruits.

In another tree labelled *M. baccata,* obtained from a different source, of 199 flowers enclosed in five bags a total of 50 fruits developed. Apparently this plant was more than feebly self compatible. Difference such as this is frequently seen for different individuals of a single species.

M. Arnoldiana; five bags enclosed from 29 to 50 flowers each with a total of 190 flowers but only three fruits matured.

M. Sieboldii; 5 flowers, 1 fruit; 35 flowers, 2 fruits; 38 flowers, 2 fruits; 42 flowers, 2 fruits; 54 flowers, 5 fruits. For this plant, of the 174 flowers enclosed, only twelve gave fruits.

The examination of pollen under microscope and tests for its germination in artificial media were made for each of the plants. For the pollen of *M. coronaria* the percentage of "good" or germinating grains was low (about 10%) but those that did germinate made a vigorous growth. In all other cases the pollen was excellent with vigorous germination of from 75% to at least 90% of all grains. Pollen abortion is hence not in any way accountable for the self-fruitlessness of these apples as it is in such plants as the grape in which intersexes are present. Of the trees tested, only the tree of *M. baccata* and the tree of *M. sylvestris* bore lightly, but for these there was a light bloom, so the trees in question were able to produce fruit.

It seems evident from these results that self-incompatibility is present in at least some individuals of certain species of apples. The flower parts are perfect and able to function in certain cross relations but there is failure to fertilize and to set fruit to self-pollination. The tests indicate that some individuals were fully self-compatible, others feebly self-compatible and others completely self-incompatible. This type of sterility with such individual differences as here observed is frequent even within many species of plants both wild and cultivated. It should be noted that the tests do not show the extent to which the many individuals grown from seed in each species are self-incompatible. Possibly the various grades exist in many or all the species noted above. Some individuals may be fully self-compatible and others fully self-incompatible in the same species. Tests

FIGURE 3. A tree of the wild apple (*Malus coronaria*) of the northeastern part of North America. The tests indicate that all the fruits on this tree were the result of cross-pollination from trees of other species or from trees of cultivated varieties that were planted nearby. In the wild, there would be opportunity for successful cross-pollination between different seed plants of this species and also some plants may be highly self compatible and self-fruitful.

of various plants from different seed origin are necessary to determine this.

Apple trees growing wild are, except perhaps for origin through root suckers, each from a different seed and unless there is isolation there is opportunity for cross-pollinations. Under such conditions incompatibilities and also cross-incompatibilities between individuals from different seed are not at all obvious in the setting of fruit.

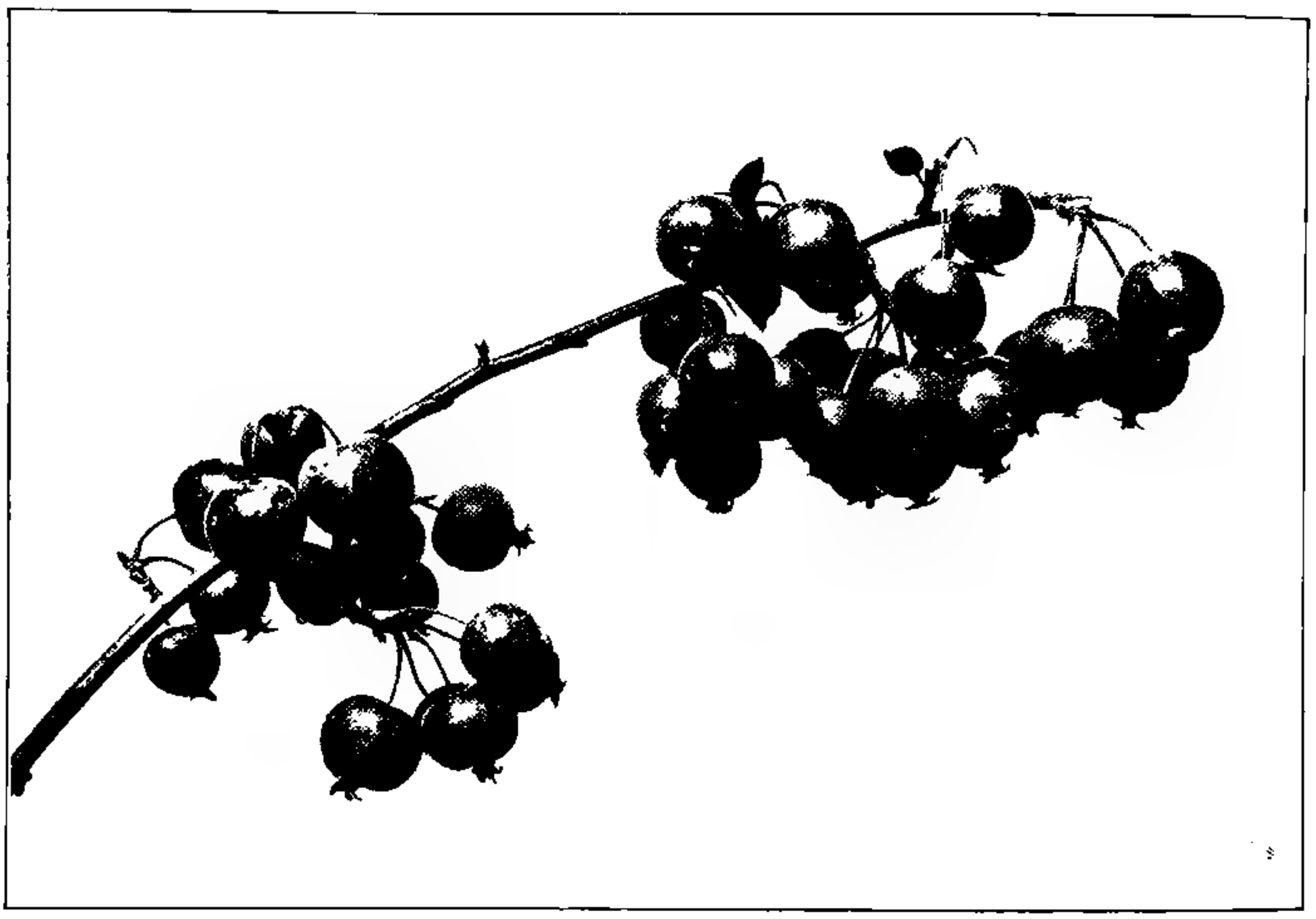

FIGURE 4. The fruits shown above are from the self-pollination of flowers enclosed within a paper bag on a branch of a tree of *Malus Malus*. The plant is fully self-fruitful but some of its seed progeny may be entirely self-incompatible.

In cultivated apples, all the trees of a variety are from branches derived by vegetative propagation from one seedling or bud sport. It is a *"clonal"* variety in contrast to a variety grown from *seed*. Pollination between two plants of a clonal variety is the same as pollination from flower to flower on a single tree. This is not cross-pollination but close-pollination. When there is complete self-incompatibility in a seedling apple plant the

many trees of the clonal variety that may be propagated from branches are fruitless unless there is compatible cross-pollination from trees of another clonal variety. This is the reason for interplanting those clonal varieties of apples that are fully or decidedly self-fruitless.

One can scarcely expect the seed of an apple tree to breed true even though the tree may be a member of a pure species. In private plantings, in botanical gardens, in arboretums, and in collections of species and varieties of the apple such as the one at the State Experiment Station, there is abundant opportunity for cross-pollination between species. But when in addition a lone representation of a species in such a collection is fully self-incompatible all its seed must necessarily be of hybrid origin. Seed collections from such sources can not be relied upon to come true to the seed parent.

It is not surprising that this type of self-sterility should exist among the individuals of various species of wild apples. They have evidently transmitted this characteristic to the varieties now in cultivation. It is, however, favorable to the interests of horticulture that some individuals, of certain species at least, and some of the clonal varieties now grown in orchard culture are self-fruitful. They do not need cross-pollination and if highly self-fruitful may be grown in solid blocks without a necessary decrease in yield because of incompatible pollination.

Those who are breeding apples to secure new and better sorts for culture will without doubt in the future give special attention to the obtaining of individual seedlings that are highly self-fruitful.

A. B. STOUT.

TROPICAL AMERICAN PLANTS AT HOME IV. THE HUCKLEBERRY FAMILY IN THE ANDES

Popular interest in the Huckleberry Family, as represented in northern latitudes, is overwhelmingly economic. Among the related Ericaceae, the family of the azaleas, rhododendrons, and laurels, occur some of our most highly ornamental shrubs, as known both in their natural habitat and under cultivation, but our Vacciniaceae contribute little in the way of ornament, if we

except the glorious crimsons and scarlets displayed by the autumn foliage of the Vacciniums. The commercial value of our blueberries, on the other hand, and more especially of the cranberries, gives prominence to this family in public estimation.

In the tropical Andes, the above conditions are exactly reversed. Very few of the Vacciniaceae there produce edible fruits, but the family exhibits many showy flowers, among them some shrubs of really splendid appearance. Their flowers, for the most part, agree in general appearance, differing from those of our huckleberries and blueberries in being many times larger, more or less elongated-tubular in form, and nearly always of some shade of red. These flowers are usually associated with an abundant foliage of thick texture and rich glossy surface, setting off their brilliant coloring to best advantage. One of the Himalayan genera has been called *Corallobotrys,* in allusion to this coral-red inflorescence. In spite of this general similarity, there are differences in form, shade of color, and disposition of flowers, sufficient to provide for ample variety in decorative appearance. To the systematic botanist, these differences are sometimes annoyingly misleading, since they may exist among the species of one genus as well as between those of different genera. Technical generic distinctions are found chiefiy in the stamen characters: their freedom from, or mode of attachment to, the corolla, their connection with, or distinction from one another, and especially in the characters of their conspicuous appendages. It is noteworthy that botanists are not agreed as to the relative taxonomic value of these characters, so that there is considerable confusion among the different generic allotments of the species. We are confronted, in our study of this group, by the oft-recurring question as to whether the existing species, exhibiting marked but slight characteristics, indicate the strong tendency to variation of a dominant group, or vestiges of a number of groups formerly dominant. The latter view has always appeared most probable to me, so that I am inclined to side with those authors who would recognize many genera, though most of them can be accorded but few species.

To the above statements regarding the absence of edible fruits among these plants, the genus *Psammisia* forms a notable exception, its berries being eagerly collected by country people, and

being often seen in the South American markets. More than thirty species of *Psammisia* are recognized, although not all of them are known to contribute edible fruits. Their principal center of development is in southern Colombia and adjacent Ecuador, Venezuela, and northwestern Brazil. They occur mostly in the cool regions in high elevations, though never, so far as my observation extends, where any frost is known.

The species best known to me appears to be *Psammisia macrophylla* (HBK.) Klotsch, which occurs abundantly in the mountains of southern Colombia, at an elevation of about 9,000 feet. We found it particularly abundant about the margin of a swamp, formerly a lake bed, in the midst of a heavy forest, near the head of the Caqueta River. Here the slender, partially twining stems ascended amidst the shrubbery to a height of several yards, somewhat after the manner of our Celastrus. The branches then droop over exposed surfaces, presenting their flowers and fruits to the air and sunshine. Along the ends of these drooping branches occur dense axillary umbelliform racemes of flowers, the entire aggregation sometimes a foot or more in length, and finally heavy with their clusters of luscious fruit. The individual flowers are pendulous on long stems. They are not so showy as those of some other genera, their color being of a rather dull dark red. They are nearly an inch in length and as thick as a lead pencil.

The fruits of this species are about as large as an ordinary cranberry, of similar form, and of a rich purple or crimson-purple color. Growing as they do in large drooping clusters, it is not strange that they should have received the native name *Uva del monte,* the equivalent of "wild grape"! These fruits are much more juicy than either the cranberry or the blueberry, and their flavor is somewhat intermediate between the two as to acidity and sweetness, although it has characters all its own. I could never learn that these plants have been introduced to cultivation, but there appears to be no reason why they would not do well when grown to trellises. The fruits of this genus are eagerly purchased when offered in the market and would doubtless be welcomed in any community. I have found two varieties on sale in the market of Bogota, one of them, called *Uva de anis,* being the product of *Psammisia sclerophylla* Planch. & Lindl.,

the other, known as *Uva Camarona,* probably from *P. macrophylla.* The former is only about half as large as the latter which, as stated, is about as large as our cultivated cranberry. Both species are well represented in the Economic Museum of this Garden.

The only other genus of this family that I have found yielding edible fruits is *Cavendishia,* of which a number of species occur in Bolivia. This genus is well distinguished by the possession of large coarsely scaly inflorescence buds, their scales often brightly colored and persisting as large floral bracts after the flowers develop, a character which emphasizes the relationship of this genus to our blueberries. The species best known to me is *Cavendishia pubescens* (HBK.) Kuntze, which is of common occurrence from Caracas to northern Chile. This species, as I know it, produces tall, stout, simple stems from a large root, their bases closely clustered, while the tops spread outward. They are mostly leafless except at the top, where they are abundantly clothed with large ovate or oval, thick and coriaceous leaves, with three to five strong ribs and entire margins. They are of a pale green color and, like the rest of the plant, softly gray-hairy. The flowers are in large corymbose racemes, at or near the summit, these being sometimes nearly or quite a foot in diameter. The individual flowers are of a dark dull red, and downy with gray hairs, being thus not nearly so showy as those of some related genera. They are often nearly an inch in length, stoutly tubular and crowned with five very short teeth. The fruits are of a deep purple-red and grayish downy. They are larger than our largest wild blueberries and shaped like them, although slightly angled or lobed on the top, which is depressed in the center. They are but slightly sweet, and are devoid of pronounced flavor. They might be described as insipid or "mawkish." This species grows at rather high altitudes along the banks of streams in sunny places. *Cavendishia acuminata* (Hook.) Benth. and *C. cordifolia* (HBK.) Hooker, of the northern countries, are much smaller and more slender shrubs. *C. paniculata* Rusby, collected by the author, and also by Miguel Bang, in Bolivia, differs from all others that I have seen in its drooping paniculate inflorescence. It is probably the most showy

species of the genus, its habit being more like that of the genus *Macleania* than of its immediate relatives.

The more highly ornamental members of the family are found in the very interesting genera *Ceratostemma* and *Thibaudia,* held by some authors to be but one, and united by them under the latter name. Not only do I incline to the opinion that the two are distinct, but I feel very doubtful as to the propriety of maintaining the generic identity of all that have been included in *Ceratostemma.* This name, meaning "a crown of horns," is in allusion to the twenty extremely long attenuate horns of the anthers, the light-yellow tips of which usually project slightly beyond the corolla's mouth, forming a sort of crown to the flower. The genus, even with the exclusion of *Thibaudia,* is a rather large one and occurs throughout the mountain regions of Central and South America, as well as in the West Indies. These shrubs are fond of damp rocky locations, like those inhabited by our high bush blueberries, and they are often found in sphagnum bogs. They vary greatly in size as well as in habit. Their flowers are cylindraceous, enlarging gradually toward the summit, but with the mouth abruptly contracted. The five teeth are short and may be erect or variously recurved or reflexed. *Ceratostemma Hookeri* Britton, perhaps better known as "*C. elliptica* Hooker," is one of the more common and abundant species in the northern Andes. It is a dwarf shrub, its numerous branches erect and densely leafy, the scarlet flowers about an inch in length, rather thinner than an ordinary lead pencil, and crowded toward the summit. *C. Mandoni* Britton is similar but the plant is more slender and more densely branched, and the flowers larger and growing in large masses terminating short branchlets distributed thickly along the stems. One of the loveliest sights that I observed in my Andean collecting was one of these plants winding spirally around a small tree trunk to the height of four or five feet, clothed nearly from base to summit with its coral-red flowers and constituting a sort of a festoon to the supporting trunk. *Ceratostemma serrata* Britton is peculiar in having its large leaves obscurely serrulate; its light scarlet flowers are recurved and borne in dense axillary clusters.

The genera *Anthopteris* and *Eurygania* are very similar to *Ceratostemma,* but their flowers are usually smaller.

A species of *Thibaudia* collected in Colombia by Pennell and Killip, and probably not named, has densely flowered secund axillary racemes more than six inches in length, and must be very showy when growing.

Several of the less showy genera are of considerable scientific interest. The genus *Rusbya* Britton, of which two species are now known, differs from all other plants in this family in the possession of stipules. *Vacciniopsis* Rusby, formerly regarded as a scarlet flowered *Vaccinium*, has peculiarly bracted prismatic flowers. *Sophoclesia*, of which many new species are now being collected, is a genus of small, very slender shrubs, their little flowers pendulous on long filiform stems, and mostly of dull coloration.

Many of these plants appear to be saprophytic, in greater or less degree, and would probably prove difficult of cultivation.

H. H. Rusby

THE TREES OF ST. AUGUSTINE

The trees of the oldest city in the United States cannot fail to be interesting, especially with such a climate and such a setting. As one sits in the old slave-market shelter in the Plaza, with a table for checkers and a table for dominoes and a bubbling fountain of artesian water between, he looks out on aged red cedars shading the horse-shoe courts and extending their long sheltering branches over the pavilion itself. These are among the oldest original trees, seen in picturesque groups about the gray walls of Fort Marion and scattered here and there through the town and adjacent woodlands. The northern end of Anastasia Island, seen across the bridge eastward from the Plaza, is mostly covered with stunted specimens of this tree, which differs decidely in shape from the trim, conical red cedar of Virginia and New York.

Next in abundance in the Plaza is the live-oak, also very gnarled and picturesque in appearance and extremely common along the coast in soil that is rather moist and fertile. On the dry, sandy soils away from water, the live-oaks give way to pines and scrub-oaks that drop their leaves as do our northern species. It is the live-oak that wears so well its showy dress of long gray "Spanish moss."

A small-leaved elm is quite common in St. Augustine, one tree in the Plaza being of considerable size and scarcely differing from the ordinary American elm except in the size of its leaves. The southern magnolia need only be mentioned, since it is so well known as far north as Philadelphia and New York. This magnificent tree, with its handsome blossoms and foliage, is never out of sight, either along the streets or in the woodlands near the city. Palms of various species are likewise extremely common, the cabbage palmetto being native. The landscape effects about the Ponce de Leon hotel and certain other buildings are produced chiefly with tall, symmetrical palms. The trunks of the palmetto are also used extensively for piles along the waterfront, being extremely resistant to boring mollusks and fungi.

The hackberry and the pecan are seen occasionally on lawns in the city, while imported trees like the Melia, London plane, white mulberry, eucalyptus, arbor-vitae, mimosa, and cycas are more or less abundantly planted. Citrus trees—the grapefruit, orange, tangerine, lemon, and kumquat—predominate in the orchard and garden; while the peach, fig, Japanese "quince," banana, and papaya are not rare.

The camphor-tree is represented by two or three specimens in the Plaza and by a number of trees of various ages throughout the town. It is a shapely tree having gray bark, green twigs, and smooth, ovate leaves with prominent veins and very shining upper surface. All parts are highly aromatic in flavor, reminding one of the sassafras, which it greatly resembles except in its foliage. The small berry-like fruits are now just mature and are abundant on most of the older trees. In St. Augustine, the drupes are mostly solitary on short stems, looking like shining black shoe buttons on enlarged green pedicels; while a tree in Daytona, in the southeast angle of Ridgewood and Orange avenues, bears several fruits on a single branched stalk. Some trees have variegated leaves, with green centers and highly ornamental pale-yellow margins. The Dupont Company is attempting to grow the camphor-tree on a commercial scale in Florida.

Shrubs and shrubby vines abound and add greatly to the beauty of the city. The most conspicuous shrub is probably the oleander, which grows luxuriantly; although the Chinese rose (*Hibiscus*) and the wax myrtle (used for hedges) are fully as common.

Yucca is used in different species; also the American agave; the small bamboo; the Florida Zamia or coontie, a member of the cycad family; the castor-oil plant; the canna; the big, white-flowered Datura commonly planted in Cuba and elsewhere; the "asparagus" of florists; and the gorgeous climbing vine, Bougainvillaea, so extravagantly admired by all travelers in tropical lands. The Christmas-flower, Poinsettia, is planted everywhere and is now at the height of its beauty. I have just been admiring a fine hedge of it along the north wall enclosing Mr. Rockefeller's place at Ormond Beach. The wall is fully a yard in height and the shrubs project above it two or three feet, making a very handsome and gaily colored border.

W. A. MURRILL.

ST. AUGUSTINE, FLORIDA,
DECEMBER 10, 1924.

THE FRINGED GENTIAN

The scattering of Fringed Gentian in many different places in Westchester County, N. Y., an account of which was published in the November, 1923, issue of the *Journal of The New York Botanical Garden,* brought requests for seed from people in more than twenty different states, among them being Maine, Missouri, Arkansas, California, West Virginia, and Florida. A letter from Mrs. Coolidge states that some of the Pleasantville Fringed Gentian seed has been scattered according to directions on the White House grounds and that she "will watch with interest the development of these charming flowers."

I have mailed about five hundred packets of seed besides furnishing some to be planted along the Bronx River Parkway.

Fringed Gentian may be grown in pots and transplanted, but many of the plants die and they do not make the growth that we find under the wild conditions.

It has been demonstrated that the seed may be stored over winter if kept cool but the best results are obtained when the seed is scattered at once where it is to grow. My best planting is a spring-watered slope of light loam in an open field where a growth of grass and weeds protects the young plants.

Those who wish to try growing Fringed Gentian indoors

should select a nine-inch pot and in the bottom place one inch of gravel. On top of that put two inches of sand followed by two inches of good garden soil which has been baked to destroy weed seeds, and finish the top with two inches of baked garden soil mixed with pulverized moss.

Sow the seed on top of this but do not cover with soil. Place the pot in a dish about two inches deep and fill the dish with water often enough to keep the top soil from drying. Keep the pot in a window where the direct sunlight will not strike it. In

FIGURE 5. Four-months' seedlings of Fringed Gentian (*Gentiana crinita*).

a little less than a month the plants will show as green pin points. About a month later thin out and transplant most of them and two or three months later transplant to spots where they are to remain. The roots are long, smooth, and brittle, and if the tap-root is injured, the plant will die.

The following directions were mailed with each packet of seed:

"Scatter the seed in the fall or early winter where the Fringed Gentian is to grow, in a thinly shaded spot with good drainage, and plenty of moisture, in a rich light loam. About the middle of May the plants begin to show as little green points and in the open field are difficult to find. In September the plant finishes

the first season's growth, which consists of a rosette of six to eight leaves, the whole being about the size of a twenty-five cent piece and growing close to the ground."

Through the courtesy of Dr. A. B. Stout, who has grown Fringed Gentian successfully, we are able to show a photograph of the young plants.

The stem does not grow until the second spring, beginning in April and blooming at an average height of eight to twelve inches in September and October.

The seed crop is sometimes destroyed if an early frost catches the seed pods before they ripen and as the Fringed Gentian is propagated from the seed only, there are few flowers the second autumn after the freeze.

Some of the seeds do not germinate the first spring but "sleep over" and eventually there is a field of blue to greet one every fall.

The seed is not sold but given away to flower-lovers, and I will continue to gather it and mail to those who forward postage.

GEORGE F. NORTON,
320 East 176th St.,
New York City

GENTIANA CRINITA

The publicity which has been given to the planting of Fringed Gentian and the interest which it has aroused is one of the most gratifying features of Dr. Norton's successful plantations. The amount of seed which one field produces is large and as this field is inside the limits of a fast-growing town and is likely to be built over within a short time, Dr. Norton and Dr. Stout are doing a good work in giving the matter wide publicity and the seed wide distribution. Requests have come in from many of the local garden clubs for information and seed, and many have been inspired to go and do likewise and to supply their friends with seed, so it would appear to have started a chain, which we hope will be "endless."

Incidentally we have learned that in the December number of the *Garden Magazine* for 1905, pp. 210–212, there is a most interesting account of the growing of Fringed Gentian from seed,

with a picture of the gold medal given by Doubleday, Page and Company to Mr. Murray, Head Gardener to Mr. Pierre Lorillard at Tuxedo. The article is ilustrated by excellent photographs, both of cultivated and wild plants and shows the differences in results between natural and artificial conditions.

This year the late frosts and warm season kept the gentians in flower until November 16th, so that an abundant crop of seed ripened and almost a pint was gathered by Dr. Stout. This has either been distributed or planted in The New York Botanical Garden, and we hope for results within two years, for the Fringed Gentian is a biennial and this must be remembered when early frosts or very dry seasons occur.

ELIZABETH G. BRITTON,
Honorary Curator,
New York Botanical Garden

PRELIMINARY NOTICE OF A PROPOSED INTERNATIONAL CONFERENCE ON FLOWER AND FRUIT STERILITY

There have already been held under the auspices of The Horticultural Society of New York two important conferences on matters of vital interest to horticulture. One conference in 1902 was on "Plant Breeding and Hybridization" and one in 1907 was on "Plant Hardiness and Acclimatization." The papers presented at these conferences were published by the Society as volumes 1 and 2 of its Memoirs.

For some time the officers of the Society have had in mind the holding of another International Conference on some subject of timely significance to the progress of horticulture. After careful consideration the Council has decided that the subject of this conference be "Flower and Fruit Sterility." A Conference Committee consisting of N. L. Britton, Chairman; Frederic R. Newbold, Treasurer, and A. B. Stout, Secretary, was appointed, the organization of advisory committees was authorized, and a sum of money appropriated for the expenses of the conference and for the publication of its proceedings.

A preliminary statement of the main features of the conference may be made at the present time as follows:

Scope: The conference will consider the phenomena of sterility and fertility in fruit and seed production with special reference to (a) the breeding of floricultural plants, (b) problems of fruit growing and seed production in horticultural and agricultural crops, and (c) the botanical and genetical aspects of sterility and fertility.

Character of the Sessions: It seems desirable to hold a three-day conference with one day devoted to the interests of floriculture, one to the problems of fruit growing, and one to the more purely scientific aspects of the subject. There will be invitation papers of the symposium type, with shorter and more special contributions as offered. It is planned to have invitation papers presented by several noted horticulturists, botanists, and geneticists, especially from Europe.

Time and Place: An International Conference on Plant Sciences is to be held at Ithaca, N. Y., in 1926, which will be attended by horticulturists, geneticists, plant physiologists and others who will also be interested in the work of the Conference on Flower and Fruit Sterility. For this reason it has been decided to hold the conference in New York City during the week of August 9–16, 1926. This will immediately precede the Ithaca Conference, whose sessions are from August 16th to the 23rd.

Further notices regarding this conference will be made from time to time. An effort will be made to reach all who are interested in the subject.

The coöperation of all who are interested in this conference is requested. The committee is now ready to receive titles of papers and an early report from those who plan to attend and particularly from those who wish to present papers is requested.

In behalf of the Horticultural Society of New York,

A. B. STOUT,
Secretary, Conference Committee.

PUBLIC LECTURES FOR MARCH AND APRIL

The following is the program of the Garden's free illustrated lectures for March and April. They are to be held in the Museum Building on Saturdays, beginning at 3:30 P. M.:

March 7. "Yosemite Valley and the Big Trees."

Dr. H. R. Rose

March 14. "Alpine Flowers of the Rocky Mountains."
Dr. P. A. Rydberg

March 21. "Plant Cancers." Dr. Michael Levine

March 28. "Camping and Collecting in the Mountains of Chile."
Mr. G. T. Hastings

April 4. "Porto Rico and the American Virgin Islands."
Dr. F. J. Seaver

April 11. "Across the Trail of Linnaeus in Arctic Lapland."
Dr. G. C. Fisher

April 18. "European Influences in American Botany."
Dr. J. H. Barnhart

April 25. "Flowers for the Spring Garden."
Mr. K. R. Boynton

NOTES, NEWS, AND COMMENT

Doctor A. B. Stout of the Garden staff is spending six weeks during February and March in southern Florida in studies of the flower behavior of avocados with reference to pollination and the setting of fruit. This work is being done in coöperation with the Florida Avocado Association and with representatives of the state and of the Bureau of Plant Industry.

Dr. N. L. Britton, Director-in-Chief of The New York Botanical Garden, sailed for Porto Rico and the Virgin Islands on January 22nd, accompanied by Mrs. Britton, and by Mr. Kenneth R. Boynton, Head Gardener. They will continue botanical investigations commenced there several years ago, in coöperation with the insular governments, and obtain plants and specimens desired for the collections at Bronx Park. Part of the scientific results already reached have been published by the New York Academy of Sciences in the form of "Descriptive Flora of Porto Rico and the Virgin Islands," which gives descriptions, in English, for the first time, of several hundred species of West Indian plants. Mrs. Britton will pay especial attention to the mosses of the region, preparatory to writing descriptions of them for the Flora. Mr. Boynton will study the gardens of the islands, with especial reference to economic plants and ornamentals; a

favorable opportunity is afforded in the recent introduction by the Department of Agriculture and Labor of Porto Rico, of many important plants from other tropical regions.

Dr. Ephraim Hareubeni, former botanical adviser of the Palestine Government and a student of the flora of Palestine for eighteen years, visited The New York Botanical Garden on January 31, accompanied by Mrs. Hareubeni. Dr. Hareubeni has been in America for several months. He maintained for a time an exhibit of the flora of Palestine at the New York headquarters of the Society for the Advancement of Judaism. The exhibits there were arranged in three series, one arranged with reference to the ecological associations of the species, another illustrating plants used in medicines, and a third illustrating his and others' identifications of plants mentioned in the Hebrew and Christian Scriptures. On the evening of December 9, Dr. Hareubeni (Rubenowitch) addressed the Torrey Botanical Club on "New Light on the Flora of the Old and New Testaments."

The many friends of Edward Blanchard Chamberlain will be shocked to learn of his sudden death, at his home in New York City, on Monday evening, February 2, 1925. He was born at Bristol, Maine, July 24, 1878, and from his graduation at Bowdoin College in 1899 devoted his life to teaching. He was an instructor in botany at Brown University from 1899 to 1901, and taught in Washington, D. C., from 1904 to 1906, but for more than eighteen years he had been science master at the Franklin School in New York City. He was a member of the New England Botanical Club, the Torrey Botanical Club, and the Botanical Society of America, and he devoted much attention to the flora of his native state, where he spent his summers; but his chief botanical interest was in mosses. He was a charter member of the Sullivant Moss Society; its president in 1905–07; and its painstaking and efficient secretary-treasurer continuously since 1914. For many years he was in charge of all of the foreign exchanges of the Society, and contributed many papers to its official organ, *The Bryologist*. He was a frequent and welcome visitor at the herbarium of The New York Botanical Garden.

Meteorology for January.—The total precipitation for the month was 3.35 inches, of which 2.45 inches (24.5 inches by

snow measurement) fell as snow. The maximum temperature recorded for each week were *48° on the 8th,* 46° on the 17th, 44° on the 25th and 47° on the 26th. The minimum temperatures were 18° on the 7th, 12° on the 15th, + 1.5° on the 24th and *— 3.5° on the 28th.*

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JOHN K. SMALL

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ARTHUR HOLLICK

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HOUSE PLANTS AND THEIR CARE

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SILK-TOP THATCH—THRINAX PARVIFLORA

(WITH FIGURE 1)

From prehistoric times no tree, perhaps, has been so cherished by man as the palm. Food, raiment, utensils, boats, and houses, festive drink, and theme for poetry—the palm has furnished them all and more. Had palm trees grown in the Garden of Eden, the palm leaf, perhaps, would have appeared in early ecclesiastical literature instead of the celebrated leaf of the fig. As it was, the palm, wherever it grew, was early worked into ecclesiastical symbolism and idolatrous worship by the ancients. There are millions of human beings to-day in all countries from the Arctic to the Antarctic who carry on the tradition.

It is no exaggeration to say, therefore, that this eminent tree-group not only satisfies man's physical needs, but in some degree answers to the craving of his soul as well.

Thrinax was the most recent genus of palms, except one, to be added to the known flora of Florida. The first reference to *Thrinax* in our literature occurs in the Botanical Gazette[1] in 1878, in a paper by A. W. Chapman.[2] In it he refers some speci-

[1] Botanical Gazette **3**: 12. 1878.

[2] Alvan Wentworth Chapman was born 28 September 1809, at Southampton, Mass. He graduated from Amherst College, where he attended Amos Eaton's lectures on botany, in 1831, and spent the next few years as a teacher in Georgia, where he studied medicine. He removed to Florida in 1835, and was a physician at Apalachicola from 1847 until his death more than fifty years later. The first edition of his famous "Flora of the Southern United States" was published in 1860. He died at Apalachicola, 6 April 1899, in his ninetieth year.—JOHN HENDLEY BARNHART.

FIGURE 1. On Rachel Key, Florida Reef.—A silk-top thatch growing on coral (Key Largo) limestone, in foreground. Dense hammock consisting of typically West Indian trees, in background. On the Keys this palm frequently becomes twenty-five feet tall, while in the marl of the Cape Sable region, across Florida Bay, it often grows much taller. The stems are used to make turtle-crawls and for rafters of shacks; the leaves furnish thatch and are, sometimes, woven into braids and ropes.

mens from southern Florida to *Thrinax parviflora* and gives the geographic distribution of the palm as "Keys along the Florida reefs, extending up the west coast as far as Cape Romano."

The species of the genus *Thrinax* in Florida have been the subjects of much misunderstanding and misinterpretation. There are three main reasons for this condition: first, decisions were based on too scanty material, where ample specimens should have been or could have been secured; secondly, the main studies were made in the closet instead of in the field; thirdly, botanists were slow to recognize the fact that in the parts of Florida where palms grow, except in the cases of the cabbage-tree (*Sabal Palmetto*) and the saw-palmetto (*Serenoa repens*), the vegetation is wholly or predominantly tropical—West Indian.

The following statements by C. S. Sargent[3] express what we knew of this thatch-palm about a quarter of a century after it was discovered this side of the Gulf Stream.

"Dry coral ridges and sandy shores from Cape Romano to Cape Sable on the mainland and from Torch Key to Long Key. Discovered by Dr. A. W. Chapman on Cape Romano in the autumn of 1875, and on Cape Sable by Dr. A. P. Garber[4] in October, 1879. This is the *Thrinax excelsa* of Florida nurserymen, but not of Grisebach. Closely related probably to *Thrinax parviflora* of Swartz, which appears to be widely distributed through the West Indies and to occur on the shore of Central America,

[3] Charles Sprague Sargent was born 24 April 1841, at Boston, Massachusetts. After graduation from Harvard University, in 1862, he entered the army, leaving the service at the end of the Civil War as brevet major of volunteers. He has been director of the Arnold Arboretum, at Jamaica Plain, Massachusetts, since its establishment in 1872, and has thus devoted more than fifty years to the study of woody plants. His work in the development of the Arboretum, and his numerous elaborate publications, have made his name familiar to all botanists and tree-lovers.—J. H. B.

[4] Abram Paschall Garber was born 23 February 1838, at Columbia, Pennsylvania. He was graduated from Lafayette College in 1868, and studied medicine at the University of Pennsylvania, receiving his degree in 1872. He went to southern Florida as a health-seeker about 1877, and while there devoted much time to the collection of the plants of that region, whose flora was then little known. In 1880 he also collected plants in Porto Rico. In 1881 he returned to Pennsylvania, and died there, at Renovo, the same year, 26 August.—J. H. B.

but distinct from that species, as collected by Charles Wright[5] in Cuba (no. 2329), and determined by H. Wendland,[6] in its longer and stouter fruiting pedicels, smaller fruit and deeper seminal cavity, and pronounced unlike any of the species of *Thrinax* in the Herbarium of the Royal Gardens at Kew, where, through the courtesy of the director, Mr. W. T. Thiselton Dyer,[7] my Florida material has been compared."

The above quotation is a note accompanying the original description of *Thrinax floridana,* which, judging from recent information and study, proves to be the same as *Thrinax parviflora* of the West Indies, whence its ancestors evidently migrated years ago. In the West Indies the silk top thatch occurs in the Bahamas, in Cuba, and in Jamaica, where the specimens were collected upon which the species was founded. In Florida it is strictly maritime in its distribution and an inhabitant of hammocks in its floristics.

During the spring of 1922, in continuation of our field studies of palms, we made the silk-top thatch in the Cape Romano region

[5] Charles Wright was born 29 October 1811, at Wethersfield, Connecticut. He graduated from Yale in 1835, and thereafter, for nearly thirty years, devoted most of his time to plant-collecting. From 1837 to 1853 he collected in Texas, New Mexico, and Arizona, from 1853 to 1855 on the North Pacific Exploring Expedition, and from 1856 to 1867 in Cuba. For most of the remainder of his life he remained at his early home at Wethersfield, where he died 11 August 1885.—J. H. B.

[6] Hermann Wendland was born 11 October 1825, at Herrenhausen, Hannover, where his father was director of the royal garden. He studied botany and horticulture at various gardens in Germany, Austria, and England, became his father's assistant in 1850, and succeeded him as director of the Herrenhausen garden in 1869. During most of his fifty-two years at this institution he devoted particular attention to the study of palms, upon which he became the leading authority. He died at Herrenhausen, 12 January 1903.—J. H. B.

[7] William Turner Thiselton-Dyer was born 28 July 1843, at Westminster, London, England. He was educated at Oxford, and was a college professor from 1868 until 1875, becoming in that year assistant director of the Royal Gardens, Kew. In 1877 he married the daughter of the director, Sir Joseph Dalton Hooker, and upon the retirement of his father-in-law in 1885 succeeded him, retaining the directorship of the Royal Gardens until his own retirement in December 1905. He was thus associated with the administration of the most famous botanic garden in the world for thirty years. He was knighted in 1899.—J. H. B.

an object of search. Here is where, in 1875, it was for the first time found growing this side of the Gulf Stream. Our search was not rewarded by success; in fact, some of the older residents of the region, who have been acquainted with the palms of the Florida Keys and of Cape Sable, claim that this palm has never been found on Cape Romano to the best of their knowledge.

However, even if this thatch-palm did not grow on Cape Romano, it evidently occurred in that region, and may still exist there. In addition to the Chapman record, which merely reads, "Coast and Keys of South Florida," specimens are extant said to have been collected on "Caximbas Island, Florida, April 26, 1892, by J. H. Simpson." Since writing the above, the following information was received in a letter from Captain John F. Horr, who is the best informed man on the history of the region under consideration. Referring to the palm in question, he says:

"If I understand the problem, the *Thrinax* palm is the little palm, of which there were a few on Cape Romano in 1875. I think the turtlers of Key West who used to come there for green-turtle used them to make their crawls, to confine the turtle until ready to go back to Key West. I know of no palms of that kind near the Cape now."

The more southern islands of the upper Florida Keys represent the center of its geographic area in Florida. There the growth is phenomenal, or at least it was, before the lust for destroying every living thing reached these islands with the advent of civilized man. Thatch hammocks clothed large and small areas, just as do those of the cabbage-tree on some parts of the mainland, but instead of the ponderous and massive effect of the cabbage-trees, the light and graceful port of the thatch gives an entirely different aspect to the landscape. The pale trunks are so slender and so inconspicuous that at a distance the crowns of leaves seem to be suspended in mid-air.

From the keys in the vicinity of the Bahia Honda channel the range extends westward and northeastward, but with diminishing representation. Thus on the more northern upper Florida Keys only isolated specimens may be seen along the sky-line when cruising the waters adjacent to the islands. Sand's Key seems to be the northern limit to its range on the eastern coast, except for

a single plant now growing on the nearby Ragged Key, Number Six. It is similarly represented in a scattering way in the Ten Thousand Islands, and Cape Romano on the western coast represents the northern limit of its range anywhere. Cape Sable and the Madeira Bay region are the only places in which the species is represented on the mainland.

In recent years the name of a *Thrinax* originally applied to a Cuban palm has been associated with the genus *Thrinax* in Florida. Thus we find some of the thatch-palms of the Florida Keys and the southern tip of the peninsula masquerading under the binomial *Thrinax Wendlandiana.* As far as our observations are concerned, the diagnostic characters on record for the distinguishing of the two supposed species—*"Thrinax floridana"* and *"T. Wendlandiana"*—in Florida, may be found on the same plant. It may be of interest to note that the long sharp perianth lobes attributed to the flower of *Thrinax Wendlandiana* are prominent features in the Simpson specimen, referred to above, from Caxambas, which is the type locality, if not the exact type station for *Thrinax floridana.*

The silk-top is a beautiful and graceful palm. It may be distinguished from the other members of the genus *Thrinax* by the slender-pedicelled flowers and by the large pearly-white fruits which hang in dense long branches from the crown of rich green leaves.

JOHN K. SMALL.

SOME PLANTS CONCERNED IN THE FORMATION OF COAL*

Coal is commonly—and correctly—thought of as a mineral. It is regarded and treated as such, not only in popular articles but also in scientific literature, by both the mineralogist and the geologist, for the reason that it occurs in beds or strata and forms part of the lithosphere or crust of the earth, just as do other minerals and rocks with which we are familiar. In this form we are dealing with coal as a finished product, which belongs in

* Abstract of a lecture given at The New York Botanical Garden on January 24, 1925.

the mineral kingdom; but in connection with the facts and the story of its origin it belongs in the vegetable kingdom and comes within the jurisdiction of the botanist.

Coal is plant tissue or cellulose (represented by the chemical symbol $C_6H_{10}O_5$; or carbon, hydrogen, and oxygen, in the proportion six, ten, five, respectively) which has been subjected to natural distillation in the earth, during which process the volatile constituents—hydrocarbon gases ($C_x H_x$), carbonic acid (CO_2) carbon monoxid (CO), water (H_2O), etc.—have been driven off to a greater or less extent, leaving the bulk of the carbon behind as the solid residue which we know as coal. This was derived from the carbonic acid (CO_2) of the atmosphere, which was utilized by living plants in building up their tissues. The carbon was retained and the oxygen set free. Coal, therefore, enjoys the unique distinction among rocks of having originated from the atmosphere and not from the constituents of the earth's crust. Coal which still retains a considerable amount of volatile material is what is commonly known as bituminous or soft coal. That which has a minimum of volatile matter remaining is called anthracite or hard coal.

Wherever plant remains accumulate and are subjected to pressure and heat, with the oxygen of the atmosphere excluded natural distillation ensues. An analagous process is the artificial manufacture of charcoal. Green wood is packed in a heap, covered with earth or sods to exclude the air, and fires are maintained for a certain length of time under or around it. The wood is not burned but distilled, and the ultimate product is the carbon of the wood which remains behind in the form of charcoal.

It may thus be appreciated that the formation of coal is a progressive process, consisting of a series of changes from living to dead plant tissue and eventually to coal. Coal, then, is not necessarily confined to any particular part or parts of the world or to deposits of any one period in the geological history or evolution of the earth. Wherever and whenever plants lived and died and suitable conditions prevailed, coal was formed. Every swamp or shallow basin of water on the earth's surface today is a potential future coal bed, especially where conditions are favorable for the formation of peat.

We know that the vegetation of the earth differed in its prevailing elements from period to period. The evolution of the vegetable kingdom progressed from early, low and simple forms or types to those that became successively higher and more complex; hence the kinds of plants that contributed to the formation of coal varied greatly at different periods. The carbon in the earliest sedimentary rocks—those of Eözoic Time—is now mostly in the form of graphite. It was probably derived entirely from the remains of marine vegetation, which must have been in existence for ages before terrestrial plant life was possible.

The earliest terrestrial plants—those of Paleozoic Time—were mostly Pteridophytes or ferns, and their allies the equisetums or horsetail rushes and the lycopodiums or ground pines, but all of gigantic size as compared with their degenerate descendants of today. With these were also the Pteridosperms or cycad-ferns, an extinct class or order of plants that simulated ferns in outward aspect but bore flowers and seeds instead of spores. This vegetation reached its maximum of development at the close of Paleozoic Time, during the Carboniferous Period. This was the period of the earth's most luxuriant vegetation, if we may judge from the amount of coal that was formed. It has been estimated that a bed of coal ten feet in thickness represents more than 100 feet of average peat, or lignite, and this would, of course, represent a still greater thickness of ordinary vegetable tissue. It is certain that no such accumulation of plant remains is taking place in any part of the earth today. It is from deposits of the Carboniferous Period, therefore, that practically all of the coal of Europe and the eastern United States is obtained.

During Mesozoic Time the Pteridophytes steadily decreased in size and in relative abundance, and in its early periods—the Triassic and Jurassic—they were largely replaced by Gymnosperms, especially the type represented by our existing cycads or sago palms. The Gymnosperms became the dominant type of vegetation and the coals of these periods are largely composed of this class of plants. Triassic coals are characteristic of Eastern Asia, in China, and of a limited part of the eastern United States, in Virginia and North Carolina.

Toward the close of Mesozoic Time—during the Cretaceous period—the ferns and their allies had become insignificant elements in the earth's vegetation and the Gymnosperms were fast giving way to the deciduous Angiosperms. The bulk of the coal mined west of the Mississippi River is of Cretaceous age and is formed of these classes of vegetation, similar in their generic elements to those of today, in which we can recognize the ancestors of many of our existing broad-leaved forest trees, such as Magnolia, Sassafras, Poplar, Sycamore, etc., and gymnosperms in which Pines, Sequoias, Taxodium, etc., have largely replaced the cycads of early Mesozoic Time.

Neozoic Time, which begins with the Tertiary Period and carries us up to the days in which we are living, saw a further development of the deciduous type of vegetation. Tertiary and more recent coals are of relatively little importance except in limited localities. Some of the Alaska coals are of this age.

And finally we come to the modern peat and lignite deposits, recently formed, and in places in process of formation, from the existing vegetation with which we are familiar. These may become coal beds in the future, under favorable conditions; but they will be of little importance and will be of interest only to the geologist. Man is not only rapidly using up all the coal that has been millions of years in accumulating but he is also rapidly destroying the vegetation from which any possible future supply of coal might be formed.

Coal has been mined during a period of only about 200 years and, at the present rate of consumption, it has been calculated that the available remaining supply will be exhausted in the next 100 years. The bulk of this coal was accumulated during a period of time approximating twenty-four million years, so that in 300 years we shall have destroyed what it took nature twenty-four million years to make.

The lecture was illustrated by fossil plants representing the principal types of vegetation that prevailed at different periods of the earth's history, and charts and diagrams explaining the terms employed in designating the various kinds of coal, the sequence of the geologic time divisions and periods, the evolution of the principal types of vegetation, etc.

ARTHUR HOLLICK.

THE SOUTHERN DISTRIBUTION OF THE HEMLOCK

The Reverend J. P. Otis, of Marshallton, Delaware, has recently sent the following letter to Dr. N. L. Britton:

Marshallton, Delaware
February 2, 1925.

Dear Doctor Britton:—

I have just read with much interest the abstract of your recent lecture on "The Pinetum," as printed in the JOURNAL[1] for January (1925), especially that part relating to the Hemlock Forest along the Bronx River in The New York Botanical Garden. The statement on page two, recording that it is the "most southern hemlock forest along the Atlantic Coast" is of especial interest. In the strict sense this is no doubt true, for I know of no large area now occupied by a pure stand of the hemlock in one place any farther south in or near the Coastal Plain. Near where the States of Pennsylvania, Maryland, and Delaware meet and about the junction of the Piedmont and the Coastal Plain I have observed four localities for the hemlock (*Tsuga canadensis*).

(1) Along Octoraro Creek, a tributary of the Susquehanna River, near its mouth, I have observed hemlock trees from a point two or three miles above the Pennsylvania-Maryland State line to and even a little distance below that line. In places there is or was a quite thick fringe and some trees of great size. (2) Along Principio Creek near where it flows under the Pennsylvania Railroad embankment near the head of Chesapeake Bay, just above Principio station. The specimens here are few and scattered—but they may easily be seen from a railroad train window. (3) Almost directly east of the above-cited locality, across the mouth of North East River at White Bank, in Elk Neck, some years ago I found a hemlock of considerable size which was surrounded by quite a number of seedlings. Unfortunately I told of its occurrence there, and it was soon cut down for lumber. (4) Not far from my present home, near Marshallton, on the edge of Red Clay Creek, there is a very large tree which seems to be indigenous. I have been informed that years ago there were several trees where only one now stands.

[1] Journal of The New York Botanical Garden **26**: 1–3.

In this connection it may be interesting to note that the crag-hemlock (*Tsuga caroliniana*), still a coinhabitant of the tree in question in the Appalachian Highlands, has never descended from the higher altitudes.

I wrote of these outposts of the hemlock to Doctor Small some time ago, and he then urged me to write a note about them for the JOURNAL, but I neglected to do so at that time as I felt somewhat timid about venturing into print on the subject. For what they are worth, however, I send the above notes to you.[2]

Sincerely, J. P. OTIS.

HOUSE PLANTS AND THEIR CARE*

Our first step should be to note room and facilities that we can command for plant culture. We should look for a good sunny window and the room should not be overheated. Dry dead heat absorbs the moisture from the plants and results in filling the lung-like pores of the leaves with dust that is always afloat in atmosphere where the temperature is 70 degrees or over. Under such conditions house plants commonly perish.

To keep plants in good condition, sprinkle the leaves once or twice a day or shower the plants. The deadly dryness of the air

[2] I am glad to supplement my observations with some important facts furnished by Dr. John K. Small:

As is well known this tree is abundant in and about the Appalachian Highlands from Georgia and Alabama northward. After the emergence of the continent following the geologically recent submergence of eastern North America, except the tops of the southern Appalachians, and the general destruction of vegetation during the Glacial Period, this tree spread out into adjoining and even more distant plant provinces. East of the mountains it is not infrequent in the Piedmont, in which province the grove in The New York Botanical Garden is situated. It is, however, much rarer in the Coastal Plain. Whether it was formerly more abundant and is now dying out in that province or whether it never reached a great development there, we do not know. A considerable grove of the hemlock is said to occur on the Raritan River near the edge of the Coastal Plain, a half dozen colonies have long been known to occur in the Coastal Plain of middle New Jersey, and two localities have been recorded for Long Island, New York.

* Abstract of a lecture given in the Central Display House of Conservatory Range 2 on the afternoon of Saturday, February 14.

can be overcome in various ways. Pots can be placed on trays the bottoms of which are covered with an inch of sand or moss constantly kept wet. Also dripping wet sponges can be slipped once or twice a day in the forks of bushy pot plants. Much also can be done by choosing those plants that will grow best in warm rooms. Now a pineapple can be grown in a warm room by getting a pineapple in the month of June with a good long green top. Cut the top off close to the apple, pull off a few of the low leaves, then next day plant the top in a 3- or 4-inch pot. Use sandy soil, keep wet and in partial shade. It is a good warm room plant. Other good ones are Palms, Ferns, Asparagus plumosus, Aspidistra, Cycas, Pandanus, Sansevieria, Calla, Cacti, Ficus, etc. These will stand a great deal of heat if care is taken to keep their foliage clean and the air moist. The warm room plants grow best in the temperature of 68° to 75° in the day time and 64° to 68° in the night time.

Cool room plants grow best in the temperature of 55° to 60° in the day time and 50° to 55° at night. Plants that grow best in cool rooms include Oleander, Myrtle, Ivy, Jasminum revolutum, Camellia, Carnation, Amaryllis, Fuchsia, Geranium, Lemon, Orange, Hyacinth, Ten-week Stock, Tulips, Vinca minor, Mexican Primrose, Pansy, Snowdrop, Violet, Rose, etc.

To keep plants in good condition, always first examine the roots and soil. Nearly always the trouble is here. It has been kept too wet and the sourness has poisoned the roots or too dry and the tender feeding roots have perished or perhaps worms are found in the soil disturbing it and possibly devouring some of the nutrient substances of the soil. All this can be remedied. The worms can be killed with lime water. To make lime water, put a heaping tablespoonful of slacked lime in a pint of water, mix well and let lime settle. Next day fill pot up with lime water and repeat once a week from April to October. This will sweeten the soil and keep the worms out.

The best time to feed plants with liquid fertilizer is from April to November, the growing months. Feed plants once a week. To make liquid fertilizer, add three heaping spoonfuls of cow or sheep manure to a quart of water and mix well. Fill up pot with liquid once a week. This strengthens the plants.

Dissolve one inch square block of laundry soap in a pint of hot water, add a tablespoonful of kerosene, mix well, then wash leaves top and bottom. Do not let the emulsion run into soil, as it will burn the roots. Do not let the sun shine on the leaves for a day or two, then wash the leaves with clean water. Use kerosene emulsion only when insects are on the plants.

Mr. Becker also spoke on preparation of soil, on how and when to water house plants, on the treatment of their diseases, and on methods of propagation.

H. W. Becker.

PLANTING FLOWER SEEDS*

The flower garden season begins long before the plants are blooming. In storm-bound winter months the plans are made for this or that flower-bed or window-box. The postman brings the seed catalogues soon after New Year's. Then the varieties of flowers are selected, the order sent in, and soon the seeds arrive The seed trade of today is as reliable and honest as any other. Persons buying their flower seeds of reliable well-known firms are sure to be satisfied. There is a balmy atmosphere of garden and country in a seed store this time of the year, and city and suburban gardeners would profit if they "shop" in New York seed stores as they do in the department stores. Seeds are still 5 and 10 cents for substantial packets, a good investment. The first interesting process, before sowing time, is that of testing the seed. A saucer and a piece of blotting-paper will be sufficient to test your kinds of flower seeds, one kind at a time; other more complicated devices will test all of the kinds at one time.

If seed is purchased from a reliable dealer, it will not be necessary to test the seed to see if it is "good," but the process is interesting. For those flower seeds which are best started in the house, such as Ageratum, Snapdragon, Balsam, Marigold, Cosmos, Lobelia, Mignonette, and Zinnia, a pot or box in the sunniest window, or even the old window-box itself, will do for sowing the seed. When seedlings are big enough to be trans-

* Abstract of a lecture given in the Central Display House of Conservatory Range 2 on the afternoon of Saturday, March 29, 1924.

planted, if boxes or pots are not available, paper pots, tin cans, or even pasteboard egg-boxes may be used to hold them.

There are still many gardens inside the city limits which can be brightened by flowers from seed, and for the newly built home the summer annual flower will furnish the quickest, cheapest garden.

All the accessories to the sowing of seeds and handling seedlings, including seed catalogues, seeds, soil, pots, boxes, and a miniature garden, were shown and methods were demonstrated.

KENNETH R. BOYNTON
GEORGE FRIEDHOF.

PUBLICATIONS OF THE STAFF, SCHOLARS, AND STUDENTS OF THE NEW YORK BOTANICAL GARDEN DURING THE YEAR 1924

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CONFERENCE NOTES FOR FEBRUARY

A Conference of the Scientific Staff and Registered Students of The New York Botanical Garden was held on the afternoon of February 4.

Speaking on "Gametophytes of *Lycopodium*," Mr. Otto Degener mentioned the five general types of gametophytes and related his experiences in finding those of *Lycopodium obscurum, L. clavatum, L. complanatum, L. pachystachyon,* and *L. cernuum.* He particularly emphasized his conviction that the prothallus of *L. obscurum* invariably possesses the *L. annotinum* type of shape and never approaches that of *L. complanatum,* notwithstanding published statements to the contrary. He also remarked that wherever he found stations for the sexual stage of the first three species mentioned, mature sporophytes were not growing in the immediate neighborhood.

To procure the hitherto unknown prothallus of the Hawaiian *Lycopodium pachystachyon* was at first extremely difficult. Sporelings still attached to their prothalli were not rare in the mountains back of Honolulu among the decaying bases of epiphytic ferns. But because the root-like gametophyte of this lycopod is so small and brittle, it was impossible to dissect more than practically worthless fragments out of such material. A decaying log, however, was found on a high ridge at an altitude where the rainfall is heavy. Upon its surface were growing about a dozen sporelings. Prying the loosened bark from the wood, the ramifying gametophytes were finally found in a condition suitable for study.

Several normal stations for the gametophyte of *Lycopodium cernuum* were found on Hawaii in the vicinity of Kilauea Vol-

cano. These contained usually less than a score of gametophytes and sporelings. But in volcanic crevices whose total length might be over 2 km., many thousands of prothalli and minute sporelings were discovered. These prothalli, many with minute bright-green sporelings growing from them, studded the dark moss-covered sides of the crevices. Where the temperature of the substratum registered 40° C., only blue-green algae were found. At 35° C. a few lycopod prothalli and minute sporelings were discovered. Around 31° C. the plants were most numerous, frequently being spaced but a few centimeters apart. At 26° C. the gametophytes were comparatively rare but sickly sporelings a centimeter or more in height growing from them were common. None of these sporelings ever become mature unless they happen to develop at the edge of the crevices and are able to creep away from the heated area. As soon as they are exposed to normal ecological conditions, they become more vigorous and finally grow to maturity. These studies induced the speaker to express his belief that the optimum ecological conditions for the gametophyte differ radically from those of the sporophyte. He has formed the tentative hypothesis that during the ages the sporophyte generation had gradually diverged from the less progressive gametophyte generation until the optimum conditions for growth of the one are almost inimical to that of the other. Such a theory of divergence, he thought, might possibly account for the relatively unsuccessful sexual method of propagation of most lycopods and their great dependence upon vegetative reproduction. Prothalli of the five species as well as photographs were exhibited.

Under the title of "Notes on South American Mosses," Mr. R. S. Williams spoke briefly on some South American mosses collected for the most part by Pennell and Killip in 1922. This collection consisted of something over one hundred species obtained in Colombia from near sea level up to 4,300 meters elevation or at a height of over 14,000 feet. Five or six of the species apparently are new to science. One of them, related to *Bryum*, seems to be sufficiently distinct to constitute a new genus, differing from *Bryum* chiefly in its peristome.

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VOL. XXVI APRIL, 1925 No. 304

JOURNAL

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ACCESSIONS

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THE TENT CATERPILLAR

(WITH FIGURE 1)

Occasionally some of our native insects which are always with us, but not serious, occur in such unusual numbers as to constitute a menace or epidemic. This was the case last year with the insect commonly known as the apple-tree tent caterpillar. Gardeners and garden clubs, as well as individuals, became very much excited over the destructive work of this pest. Unfortunately, after the insect has completed its work for the season the incident is forgotten by many and the organism passes its dormant stage without molestation and is ready for increased business the following season. In order to handle such problems intelligently it is necessary to have detailed information on the life history and habits of the organism causing the trouble. The present paper is an attempt to place before the public some of the well-known facts concerning the tent caterpillar and means of controlling it.

LIFE HISTORY

Most insects have several distinct stages in the course of their life histories, the egg, the larva or caterpillar, the pupa, and the adult. The last may take the form of a butterfly, a beetle, or a fly. The adults deposit the eggs and the life cycle is complete. The tent caterpillar, like most insects, passes through these stages, the adult taking the form of a moth.

EGG STAGE

The eggs are deposited in masses resembling wads of chewing gum on the twigs of the trees. The adults seem to show a great deal of discretion in the selection of the proper tree, placing the

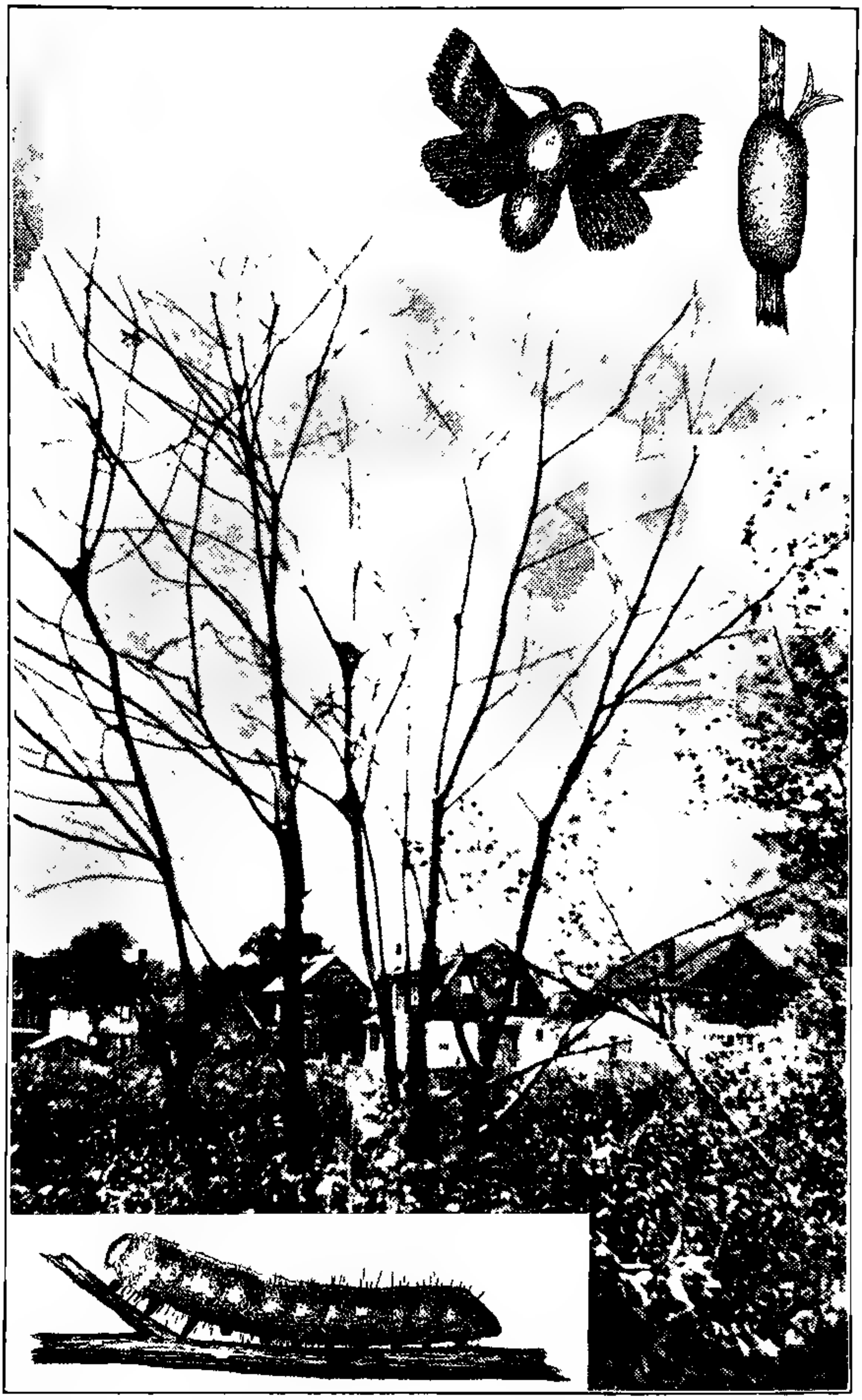

FIGURE 1. Photograph of wild cherry trees at Scarsdale, New York, which have been entirely denuded by tent caterpillars. This is not a winter scene but defoliated trees as they appear in the month of June.

Drawing of an adult moth and egg cluster about natural size, upper right hand corner; caterpillar, slightly enlarged, lower left hand corner.

Photograph by Mrs. Wheeler H. Peckham; drawings by the author.

eggs on the twigs of one which is suitable for the food of the offspring, usually selecting a wild cherry or an apple tree, or some very closely related plant. Usually the caterpillars stick to the plant on which the eggs are deposited but when present in large numbers they often fall to the ground and migrate to other trees or shrubs. Even the caterpillars seem to have amazing powers of discrimination and have been seen to pass by a lilac bush and select a rose bush instead on which to feed, the rose being much more closely related to the apple and cherry than the lilac. Thus these lowly organisms are more expert in detecting the natural relationship of plants than are some of the human kind.

The larva or caterpillar

Very early in the spring, as soon as the buds begin to open, the larvae appear, each egg cluster giving rise to about two hundred caterpillars. About two days after hatching the minute caterpillars begin the formation of their nests, usually in the crotch of a branch. This is enlarged to serve the demands of the insect whose rate of growth is in keeping with its voracious habits. When fully grown the caterpillar is about two inches in length and is daily able to devour almost its own weight in food. In about six weeks from hatching the insect becomes restless and finally wanders from its nest in search of some secluded place in which to build its cocoon. Within the cocoon the pupa is formed and in about three weeks more the adult appears.

The adult

The adult of this insect takes the form of a beautiful moth of a reddish-brown color. As the larva is called the feeding stage, so the adult is often known as the egg-laying stage, since their chief function seems to be to mate and deposit the eggs for the coming generation. The eggs are deposited in the late spring or early summer and fortunately, from the control point of view, the insect remains dormant until the following spring.

Methods of control

Like most biting insects, this one can be checked by the use of poison sprays, such as arsenate of lead, but this method often requires apparatus not at the disposal of the average person. Cutting off the nests when the caterpillars are at home is also effec-

tive. Removing the trees on which the insect feeds has also been recommended, especially the wild cherry, which is of little economic importance.

Since this insect has a long dormant season, one of the most practical and economical means of control consists in collecting the egg clusters which are easily recognized and not difficult to secure. A number of campaigns have been conducted in Westchester County, where the insect was especially destructive during the past season. We take the liberty of quoting the following statement by J. G. Curtis, Manager of the Westchester County Farm Bureau, as to the results of

THE CATERPILLAR CONQUEST

"On Saturday, March 7th, there were cremated in bonfires in the four cities and eighteen townships of Westchester County, 1,827,661 tent caterpillar egg masses, each of which contained about 400 eggs, which would have hatched young caterpillars early in April to destroy the foliage of trees and build the large white nests which caused the unsightly appearance of the otherwise beautiful highways throughout the county last year.

"The Westchester County Board of Supervisors, at the request of its special committee, of which Mr. Louis Milliot, of Yonkers, is chairman, appropriated five thousand dollars to the Westchester County Farm Bureau to be used for the payment of a bonus of 25 cents per 100 egg-masses gathered during the last two weeks of February, to each volunteer pupil in the city, village, district, and parochial schools in the county; and an engraved silver cup to the pupil in each city and each township securing the largest number; and a special cup to the school in the county securing the most.

"This resulted in the destruction of nearly two million egg masses gathered by 4,067 pupils in 147 schools, counted and certified to by the teachers, and destroyed by the city foresters in the cities and the town clerks in each township.

"The school winning the county-wide cup was Hawthorne Public School No. 7, Mt. Pleasant, in which 106 pupils gathered 99,200 egg masses; and the pupil gathering the most in the campaign was Daniel Lehning, of St. Joseph's Normal Institute, Pocantico Hills, with 15,975.

"This fine start toward a county-wide clean up of this pest has been made possible by the splendid coöperation of the Board of Supervisors, the superintendents of schools, principals, teachers, and the pupils who did the actual work; the assistance of 200 interested organizations, and the publicity furnished by the New York City and Westchester County newspapers.

"The Girl Scouts of the county are assisting with a special campaign started on March 1st, and arrangements are being made to have the Boy Scouts make a final clean up of the pests which appear on the roadsides of the county before the caterpillars do any damage.

"It is hoped that every home owner in the county will see that his own property is freed of this pest by removing the nests with a caterpillar brush, or by the application of an arsenical spray or dust, to the foliage of all the trees containing nests, while the caterpillars are small and easily killed."

It is hoped that similar campaigns may be carried on during the coming season in other localities and that the ravages of this insect may be materially checked.

FRED J. SEAVER.

THE HISTORY AND DEVELOPMENT OF GREENHOUSES[1]

Nearly two thousand years ago, the Romans had made considerable progress in horticulture. The climate of Rome was mild, yet it was too severe at times for the culture of certain plants then recognized as desirable, particularly those producing edible fruits. The resulting plant-houses, the earliest of which we have definite record, were tight and dark, used only in brief emergencies, and adapted to the survival rather than the development of the plants placed in them. It is believed that, although their main object was to exclude cold, they were sometimes, like the Roman baths and palaces, warmed by hot water conducted through bronze pipes.

[1] Abstract of a lecture given in the Central Display Greenhouse, Conservatory Range 2, of The New York Botanical Garden, on Saturday afternoon, February 28, 1925. The lecture was illustrated with old prints, showing types of early greenhouse construction.

Sheet glass was not unknown to the ancients, but the development of greenhouses was dependent upon the production of such glass of sufficient transparency and cheapness to be in common use for windows, and this was not until many centuries after the beginning of our era. It was at one time customary, in the English language, to distinguish between the greenhouse, in which the sun's rays were the only source of heat (save perhaps in the severest weather), and the hothouse, in which artificial heat was supplied at all times (except perhaps on the hottest days of summer). But now, when our large conservatories comprise various houses, cold, hot, dry, and moist, this distinction has largely broken down, and the word "greenhouse" is used for any glass plant-house managed from within; that is, any such structure that is more elaborate than the hot-bed or cold-frame.

Modern display greenhouses were preceded by the culture of plants indoors, in the homes of the wealthy. Of course, the plants themselves were not diffident in indicating their need of light, so they were placed near windows; then the windows were made larger on their account; then special rooms were added to the house for their accommodation, with much glass on one or more sides. The addition of a glass roof and the separation of the plant-house from the mansion completed the line of evolution, and each of the intermediate phases has persisted to the present time.

This line of development began during the seventeenth century, and the same period witnessed the development of another and quite different line. This started with the fruit-wall. Cultivators in middle and northern Europe had discovered that fruit-trees and vines, if planted on the south side of a wall, would grow as if they were in a decidedly warmer climate, and special walls were erected for this purpose. Such walls served both to protect the plants from bitter blasts from the north, and to warm them by reflecting the sun's rays. It occurred to some one to cover in the south faces of these walls with glass, and this was the origin of the orangeries which made possible the ripening of semi-tropical fruits in northern climates. There was an orangerie in Paris as early as 1640; one in Berlin in 1657; and there were several in England in 1664. It was a short step from this type of construction to the long, narrow greenhouse, running east and

west, with the north wall of masonry, and the rest of glass; and an even shorter step from this to a house with the north wall also of glass. Thus has developed the modern long, low greenhouse for commercial or experimental use; and, again, we have all the phases through which evolution has taken place still persisting.

The most important feature in a glass house is the glass. The cheap glass once depended upon in greenhouse construction was decidedly greenish, and even with improvements in clearness and consequently in transparency, it was often of very unequal thickness; when the opposing surfaces were not parallel, a prismatic effect was produced, diffusing or focussing the light-rays that passed through. The most important feature of the use of glass, however, is the angle at which the glass is set, in relation to the source of light. Even when the light-rays strike the clearest glass squarely at right-angles, not all of them pass through it, and when the angle is very oblique, very few of them pass through, most of the light being reflected away from the surface. The earliest greenhouses had all of the glass set vertically, and when more or less of the roof was glassed, the slope was the same as that of the roof would have been if without glass.

There were interesting early speculations and even calculations concerning the angle at which glass should be set in order to catch the largest number of the sun's rays. Not only is the sun's altitude greater at midday than in the morning and afternoon, but it is greater in summer than in winter, when it is most needed to warm the greenhouse. It was not until about 1800, however, that careful studies showed that, in the case of flat glass surfaces, an angle of 45° was the best for practical purposes, and that angle was accepted as the ideal one in actual greenhouse construction. In 1815 it was first proved mathematically that a hemispheric roof-outline was even more ideal; such an outline was too flat on top to shed rain satisfactorily, so such roofs were actually built with a peak in the center. For more than a hundred years there has been no improvement in the form of greenhouses, though there have been changes in style in the matter of architectural effect, and many improvements in structural details.

The earliest form of artificial heat in greenhouses was an open fire in the middle of the floor. Then a closed stove was substi-

tuted, and the word "stove" for a greenhouse has continued in use in England, although it sounds strange to an American ear. Next in the line of development came hot-air systems, the stove or furnace being outside and the hot air conducted through flues lining the walls or underneath the benches of the greenhouse. A century ago both hot-water and steam systems were in use, and even now hot air, hot water, and steam are preferred according to the size of the structure to be heated and the facilities for producing heat. Steam, however, has largely monopolized the field, especially in the case of large ranges of greenhouses.

Ventilation of greenhouses is essential, and has been accomplished in various ways, but no attempt was made in this lecture to discuss in detail the systems either of heating or ventilation, or even of greenhouse construction, as such matters would be too technical to be of general interest.

JOHN HENDLEY BARNHART.

ORNAMENTAL PLANTS OF GAINESVILLE, FLORIDA

Although technically confined to one town, my subject really embraces most of the towns, villages, and farmyards of central Florida, few of which show the variety and abundance of ornamental plants seen in Gainesville. I have described elsewhere the trees—including numbers of giant oaks, magnolias, laurel-cherries, hollies, camphor-trees, and palms—handsome both in form and foliage, making the city a bower of beauty during the winter months. Now that spring is here, early in February, the water-oak and laurel-oak can well afford to shed their leaves and give place to the mulberry, wild cherry, chinaberry, and other trees that have been bare; while the pink flowers of the peach and redbud and the white flowers of the laurel-cherry, chickasaw plum, wild cherry, and dogwood will tone down the masses of green and attract the butterflies and bees.

Recalling other towns visited this winter in central Florida, such as Crescent City, De Land, Orlando, Mount Dora, and Leesburg, where the orange was the dominant tree, Gainesville offers a decided contrast, for it is practically impossible to find an orange tree or any other form of citrus tree here except an

occasional kumquat. A few miles away, where lakes and woodlands afford protection, there are citrus groves, but not here. This is a farming and trucking section, and in the city the pecan takes the place of the orange as a shapely and attractive shade-tree, as well as a producer. It is fashionable to have one or more on the lawn, now stretching bare branches above all other trees, but soon to be covered with foliage and later to shower down delicious nuts that are far too expensive to be bought for everyday consumption.

The peach, plum, pear, fig, pomegranate, and Japanese "plum," or loquat, also belonging in the category of "useful" ornamentals, are much planted in Gainesville; but the few specimens of mango and alligator pear seen here have been killed to the ground many times and bananas are often killed before the fruit is mature. Guavas, Japanese persimmons, and mulberries do well in this locality.

The mountain ebony or "orchid-tree," *Bauhinia,* which I have seen in all its splendor in southern Florida and South America, is very rare here; as is the carob-tree from Palestine and a few other introductions still on trial. The "dwarf poinciana," *Caesalpinia pulcherrima,* seems to do fairly well, however, and is much admired for its clusters of handsome red and yellow flowers, followed by short, four-winged seed-pods. The pinnate leaves are just now beginning to appear. Out at the University are several specimens of the Japanese varnish-tree, *Sterculia platanifolia,* with green bark, big coarse branches, and (later) large, sycamore-like leaves. Very few of the citizens have as yet planted this splendid southern shade-tree, being more familiar with the tung-oil tree, *Aleuritis Fordii,* having catalpa-like leaves and great clusters of pinkish-white flowers.

In a yard near the Seaboard Railway Station, there is a soapberry-tree, *Sapindus,* about eight inches in diameter and higher than the house. The bark is very smooth and grayish-green, while the leaves, the last of which are now just falling, are long and pinnate with many leaflets, remotely resembling those of some hickories. At the ends of the slender topmost branches are small clusters of yellowish, translucent, globose fruits of the size of a small plum or ginkgo fruit, containing a large brown seed which rattles when shaken. The owner of the tree told me she found

the seed in green coffee and planted it; but this species, *Sapindus marginatus,* is native to Florida and the coastal plain northward to Georgia and South Carolina, while the sumac-leaved soapberry, with winged rachis, occurs farther south. The pulp of the fruits of both species makes a lather with water.

Hedge Plants

Hedges form a natural transition between trees and shrubs, since both are employed for the frame of the yard or small garden. As stated elsewhere, the laurel-cherry tree, *Laurocerasus caroliniana,* is the favorite hedge plant in Gainesville. It is a native evergreen with attractive shining foliage, thrives in any soil or exposure, and has no enemies. The wax-myrtle, *Myrica cerifera,* also native and evergreen, makes a good hedge but it is not used here anything like so much as in St. Augustine and other coastal towns, where it does not seem to be affected by the salt-winds. The camphor-tree and American holly are rarely seen as hedge plants in Gainesville, but I have observed several fine hedges of the yaupon, *Ilex vomitoria,* which, in spite of its slow growth, can hardly be excelled for this purpose. It makes a dense bank of green with red berries peeping from beneath the shining, evergreen leaves. Glossy abelia, *Abelia grandiflora,* is naturally adapted to the hedgerow, either with or without pruning. It has dark-green, hardy leaves and white flowers, which open during the summer. The dwarf bamboo, *Arundinaria nitida,* and dwarf varieties of *Lantana,* the latter in bloom almost the entire year, are considerably planted here for screens and hedges. Among the woody vines, *Bignonia venusta,* with handsome flame-colored flowers, is a general favorite; and several small conifers, including red cedar, arbor-vitae, and biota, are freely used for this purpose.

Decorative Shrubs

Common elder, *Sambucus canadensis,* is exceedingly abundant in and about Gainesville, growing sometimes into quite a tall tree with a trunk nearly a foot in diameter. It is now covered with flat masses of white flowers and there are also some ripe fruits. The castor-oil plant, *Ricinus communis,* also reaches large size and is now covered with both fruits and flowers. Poinsettia, so long attractive, is passing, being easily affected by the February

frosts. People may be seen cutting the canes into short sections and sticking them into the ground for a new growth. *Camellia japonica* has also passed its attractive stage and is giving place to the brilliant *Azalea indica,* with white, salmon-colored, and purple blossoms. There are azalea bushes in the yard of the Thomas School probably seventy-five years old. Oleanders are abundant, their white, pink, red, and yellow flowers to appear later. The crape myrtle and spiraea have as yet neither flowers nor foliage. Hibiscus is not so common here as elsewhere, but I have seen both the Chinese and "Japanese" forms, *H. rosa-sinensis* and *Malvaviscus Conzattii,* in bloom. The Japanese flowering quince I have seen only once, and *Osmanthus* once, both plants covered with attractive flowers. Rose of Sharon is occasionally planted and hydrangea more frequently; while roses of many kinds flourish luxuriantly.

The golden dewdrop, *Duranta Plumieri,* now covered with large golden or white berries, is much planted here; while the star jasmine, *Jasminum gracillimum,* with its white, fragrant flowers, is almost as great a favorite. The cape jasmine, *Gardenia florida,* has larger, more fragrant white flowers of waxy appearance; and the flowers of *Tabernaemontana* are double and especially fragrant at night. The yellow elder, *Stenolobium stans,* has long, compound leaves and large, yellow flowers resembling some of the false foxgloves and very fragrant. Unfortunately, it is not sufficiently hardy here and I see little of it in cultivation. Southern lilac, acalypha, pampas grass, reed, cane, agave, tree yucca, and coontie about complete the list of shrubs and bushy plants that have attracted my attention in Gainesville.

Woody Vines

Shrubby vines are almost as abundant as shrubs and some, like the star jasmine, may be trained to either form. Of all the vines, the flame flower, *Bignonia venusta,* is the most popular; but just now the yellow jessamine, *Gelsemium sempervivens,* from the neighboring woodlands, is a great favorite. The Brazilian plant bears orange-red, tubular flowers in large clusters, while those of our attractive native are pure-yellow, bell-shaped, and fragrant. The Bougainvillaea, English-ivy, trumpet-creeper, ampelopsis, and honeysuckle are too well known to need comment. *Evony-*

mus radicans is rare here, while the creeping fig, *Ficus repens,* is exceedingly abundant, covering entire walls with its small, closely sticking leaves. The golden trumpet, *Allamanda Hendersonii,* is occasionally seen in spite of its tenderness; *Asparagus plumosus* is used quite commonly about porches; the coral vine, from Mexico, bears masses of pink flowers in summer; and the potato vine is now covered with fruits marvellously like Irish potatoes. Several tender, more herbaceous vines, like the morning-glory, are used for porch screens during the hot weather. The blackeyed-Susie vine, with delicate foliage like that of a sensitive plant, bears an abundance of pretty beans that are drilled and strung for beads. A lady with one of these vines on her back fence sold forty dollars worth of beads last year.

Herbaceous Plants

One could hardly attempt a list of the herbs used for ornament in Gainesville, comprising as it would most of the hardy as well as tender sorts planted in America. In a border near me now are plants of the French marigold over five feet tall and branching like a tree; in a yard to the west I can see a pretty row of sweet peas in flower; and to the south, coming up among the roses, are numbers of Easter lilies about a foot high. These lilies do well here, making good bulbs and apparently being free from disease. A single stem will often bear twenty or more blossoms. Spider-lilies also do well and are much planted. On the porches at this season, the sacred lily, or lily of the Nile, is much in evidence, with its large, six-parted, pure-white flowers containing a cup inside similar to that seen in some species of Narcissus. The angel's trumpet (*Datura*) bears an immense white flower shaped like a trumpet; the firecracker plant has rush-like foliage and slender, cylindric scarlet flowers; Narcissus of the polyanthus type is at the height of its season; the cyclamen is blooming in pots on the porches; the violet-oxalis, sweet alyssum, and purple mist-flower are brightening the borders; nasturtiums are abundant enough to be in evidence at parties; giant caladiums give good foliage effects until the cannas develop; scarlet-sage and coleus are by no means absent; a big plant called "Japanese rice" (*Aralia?*), with immense leaves, will soon throw out numerous small white flowers; and a shrubby-herbaceous species of *Lantana*

will continue to brighten and make fragrant the waste places with its clusters of pretty lilac blossoms.

Ferns are very abundant, the Brazilian sword-fern perhaps taking the lead, while the marsh shield-fern is brought in from the hammocks and planted on the north side of houses as the Christmas fern is used in the north. Maiden-hair ferns are obtained from lime-sinks nearby and grown in swinging baskets made of inverted cypress "knees." I have seen the holly fern, *Polystichum falcatum,* planted in one yard here, and *Osmunda cinnamomea* in another, but the beautiful *O. regalis* does not appear to be cultivated, although it grows luxuriantly in the very suburbs of the town. For shady lawns, St. Augustine grass is very popular; while for sunny locations Bermuda grass is much used. Carpet grass, *Axonopus compressus,* is being recommended by the University.

W. A. Murrill.

Gainesville, Florida, February 16, 1925.

EARLY SPRING FLOWERS IN THE GARDEN

Late winter usually claims but few blossoms among the trees, shrubs, and herbs. There are, however, certain native as well as foreign plants whose flowers make their appearance while the days are still cold and dreary.

The Silver Maple (*Acer saccharinum*), Thunberg's Willow (*Salix gracilistyla*), the Chinese Witch Hazel (*Hamamelis mollis*), and the Japanese Witch Hazel (*H. japonica*) flowered about the twentieth of February. Catkins of the Asiatic Hazelnut (*Corylus pontica*), the European Hazelnut (*C. Avellana*), American Hazelnut (*C. americana*), Beaked Hazelnut, (*C. rostrata*), the Dye Alder, (*Alnus tinctoria*), the European Alder (*A. Alnus*), Hoary Alder (*A. incana*), the Smooth Alder (*A. rugosa*), the European Aspen (*Populus tremula*) and the Elliptic-leaved Goat Willow (*Salix caprea elliptica*) began to elongate and shed their pollen between the eighth and twenty-third of March.

Flowers of the Red Maple (*Acer rubrum*), the American Elm (*Ulmus americana*), and the Slippery Elm (*Ulmus fulva*) also herald the coming of spring.

Unlike the Common Witch Hazel of our woodlands (*H. virginiana*), whose blossoms do not open until late in the fall, the flowers of the Vernal Witch Hazel (*H. vernalis*) made their appearance about the middle of March.

Small yellow flowers of the Cornelian Cherry (*Cornus Mas*) and its close relative Sandzaki (*Cornus officinalis*) began to brighten up the landscape by March twenty-first.

The Spring Heath (*Erica carnea*), one of the most popular of all hardy Ericas, flowered about the same time.

Scattered about the grounds are many large bushes of the Yellow Bell (*Forsythia*), a member of the Olive Family, some of which have flowered and are making an attractive display about twenty days earlier than last year. The Chinese Peach (*Amygdalus Davidiana*) showed its first flowers at about the same time.

Toward the end of March the Fragrant Honeysuckle (*Lonicera fragrantissima*) and a near relative (*L. Standishii*) from China, were also in bloom.

Within the past year the Garden has received an interesting and valuable collection of bulbous plants from Mrs. Wheeler H. Peckham. The following flowered between the tenth and twenty-second of March.

Common Snowdrop (*Galanthus nivalis*), Giant Snowdrop (*G. Elwesii*), Spring Snowflake (*Leucojum vernum*), Twinleaf Squill (*Scilla bifolia*), Siberian Squill (*S. sibirica*), White-flowered Siberian Squill (*S. sibirica alba*), Glory-of the-snow (*Chionodoxa Luciliae*), Large-flowered Glory-of-the-snow (*C. gigantea*), Grape Hyacinth (*Muscari azureum*) Scotch Crocus (*Crocus biflorus*), Cloth of Gold Crocus (*C. Susianus*), *C. Tommasinianus,* Common Crocus (*C. vernus*), and the Winter Aconites, (*Eranthis hyemalis, E. ciliaca,* and *E. Tubergeni*).

The Green Hellebore (*Helleborus viridis*), a native of Europe, was another early March bloomer and is sometimes found naturalized in our eastern states.

The Round-lobed Liver-leaf (*Hepatica Hepatica*) may also be found about the grounds, where the bees have discovered its dainty pale-blue blossoms.

The Coltsfoot (*Tussilago Farfara*), is a foreigner, having come to us from Europe. It is among the earliest members of the Thistle Family to flower.

March 26, 1925 Percy Wilson.

ALPINE FLOWERS OF THE ROCKY MOUNTAINS*

When a botanist speaks of an alpine flower or alpine plant, he means a plant growing above timber line. It does not mean necessarily that it grows in the Alps or at high altitudes. The timber line in southern Colorado is at an altitude of about 11,500 feet. Going north we notice that it is to be found lower and lower down. In Montana we find it at about 9,000 feet, in Alberta between 5,000 and 7,000 feet and it reaches sea-leved before we come to the mouth of the Mackenzie River. Then the alpine plants become arctic plants. The most common tree in the higher Rockies is the Engelmann spruce. Near the timber line it is associated with the subalpine fir, a balsam. In the northern Rockies in damper places we find also Lyell's larch and on the drier slopes the white-barked pine is found in the northern Rockies and the bristle-coned pine in the southern. For comparison's sake, a number of plants of the subalpine region were shown, first flowers of the woods, then from swamps and open places. Then the principal factors that govern the timber line were shortly discussed as: 1. Low temperature during the growing season; 2. Short growing season; 3. Late frost in the spring; 4. Strong desiccating winds; 5. Deep snow, etc. "Krumholtz" produced by the last two factors were shown.

The first vegetation that appears on the integrated rocks are lichens; from their decay a little humus is formed and other plants appear in the crevices. These are in the alpine region low and tufted. Some plants from the *rock-crests* both in the alpine and the arctic regions were shown. Another formation consists of the *rock-slides,* with almost no vegetation. Some alpine plants, as for instance some crowfoots, grow only about the edges of the melting *snow drifts.* Some other plants grow in wet places along *brooks, rills,* and *seeps* on the mountain sides; among these are a number of gentians, saxifrages, blue-bells and in the northern Rockies some species of heath, *Cassiope.* Where the ground is more level, *alpine meadows* are formed. The most numerous plants here are, of course, grasses, especially blue-grasses, but also other plants. Where the drainage is poorer, *swamps, bogs,*

* Abstract of an illustrated lecture given in the Museum of The New York Botanical Garden on Saturday afternoon, March 14, 1925.

and *lakes* are formed. The alpine bogs are of two kinds, *sedge-bogs* and *willow-bogs*. The sedge-bogs resemble much the tundras of the arctic regions. The lakes contain rarely any flowering plants, occasionally only some pond-weeds. A slide of the smallest willow in the world was also shown. This does not grow, however, in the willow-bogs but rather in the alpine meadow. It was discovered in 1897 on Electric Peak just north of Yellowstone Park at an altitude of 11,000 feet.

P. A. RYDBERG.

EUGENE PINTARD BICKNELL

News of the death of Eugene Pintard Bicknell, which occurred at his home at Hewlett, Long Island, on Monday, February 9, 1925, will come as a surprise to his many botanical friends. Mr. Bicknell was born September 23, 1859, at Riverdale-on-Hudson, then in Westchester County, but now within the limits of the Borough of the Bronx. He was a man of culture, and the inheritor of valuable traits derived from various lines of distinguished American colonial ancestry.

Interested in natural history, especially ornithology and botany, from his youth, he became many years ago one of the most widely and favorably known of American amateur botanists. At the time of his death he had been a member of the Torrey Botanical Club for forty-five years, and had contributed fifty-seven papers to the pages of its Bulletin. He was a banker by profession, long connected with the firm of John Munroe & Co., of New York City, in which, as well as the firm of Munroe & Co., of Paris, he became eventually a partner.

He was interested in The New York Botanical Garden from its earliest beginnings. His name appears in the first published list of annual members (for 1896), and in every subsequent list. In 1910 he was elected a member of the Corporation. The Scientific Directors voted to add his name to their list, November 9, 1912, and this action was approved by the Managers, April 24, 1913. His resignation as a scientific director, on account of ill health, was accepted by the board December 9, 1922, and by the Managers, January 8, 1923. He remained, however, an an-

nual member and a member of the Corporation, until his death. He contributed to several volumes of *Addisonia,* his last published botanical paper being the text to accompany plate 205 of that journal (*Hypopitys insignata*) in 1921.

JOHN HENDLEY BARNHART.

BIRD NOTES

The past winter has not had, apparently, any especially noteworthy bird visitors to the Garden.

Last year's robins were seen up to the tenth of December. A flock of some twenty cedar birds was about in that month also, feeding mostly on fruits of the thorn-apple. Owls of three species have been noted during the winter, the saw-whet, the long-eared, and one great horned, the latter being seen frequently for some two months or more. This bird was noted for about the last time on February 22, when life was being made miserable for him by two red-shouldered hawks, ably assisted by a number of crows. Chicadees have been rare, juncos and fox sparrows rather common, and song sparrows very common, with their cheerful song that may be heard every month of the year. Starlings and blue-jays have been rather more abundant than usual. Twenty years ago or so there was a period when not a single jay was seen for two or three years but now they are a common resident again.

During the January cold spell all the birds were very quiet and two robins suddenly appeared; they were, apparently, birds wintering in the North and merely shifting their quarters. The ground at the time was well covered with snow and for three days the flock stayed close by a thicket where rose hips (from *Rosa multiflora*) supplied an abundant, if not very nutritious, food, then they disappeared as quickly as they had arrived, although plenty of hips remained.

Probably the first real spring birds from the South were a flock of nine or ten grackles on March 2. On March 6, the ice on the upper lake by the Museum all melted and for several days thereafter a flock of thirty or more herring gulls made quite a spectacle, feeding on scores of dead fish floating on the water.

Doubtless the first spring bluebirds and robins from the South arrived March 9. By March 17 robins were common and in song. The next spring arrivals observed came on March 22, when one meadow lark was noted in song in the upper meadow, three flickers were hallooing from the trees, and a single phoebe was flitting about near the boulder bridge, with insects very scarce apparently. The red-wing black-bird, usually one of our most constant and earliest arrivals, was first seen on March 26, some two weeks later than usual. With the present fine weather continuing we may expect other arrivals from the South at any time.

MARCH 26, 1925 R. S. WILLIAMS.

CONFERENCE NOTES FOR MARCH

The March Conference of the Scientific Staff and Registered Students of the Garden was held on the afternoon of the fourth. Dr. J. H. Barnhart spoke on "The Geneva Library Purchase," and an abstract of his remarks follows:

"The city of Geneva, Switzerland, has long been the home of three botanical institutions ranking among the most famous of their kind in the world. One was the De Candolle herbarium, established by Augustin Pierre de Candolle (1778–1841), and maintained and developed by his son Alphonse, his grandson Casimir, and his great-grandson Augustin de Candolle. Another was the Boissier herbarium, established by Pierre Edmond Boissier (1810–1885), afterward owned and enlarged by his son-in-law, William Barbey. Until ten years ago these two great collections remained under private ownership, although visited and used almost as if public institutions by students from all parts of the world. The third, actually public, was the botanical conservatory of the city of Geneva, its great collections brought together from various sources, but based originally upon the Delessert Herbarium, one of the greatest of private collections of dried plants ever brought together; this was amassed by Baron Benjamin Delessert (1773–1847).

"William Barbey died in 1914, Casimir de Candolle in 1918, and in both cases their famous collections soon afterward became

the property of the city of Geneva and were consolidated with the collections of the already-existing city institution. Each of the great herbaria had required an equally great library for use in connection with it, and the consolidation resulted in much duplication. Some of the duplicates could be used, but an immense number were wholly superfluous, and it was determined to sell them in a single lot to some other botanical institution.

"When they were finally arranged and catalogued, they were offered, about two years ago, to the New York Botanical Garden, for 72,000 Swiss francs. The opportunity was recognized by the director, Dr. N. L. Britton, as one of the kind that comes but once in a lifetime; the offer was tentatively accepted by him at once, and arrangements begun for acquiring this wonderful collection. The books were received in August, 1923. They were packed in ninety-three wooden cases, and the weight of the shipment exceeded twelve tons. The work of incorporating so many books with the Garden library has proved no small one, as there has been little extra assistance available in addition to the regular library staff. Up to the present time, about fourteen hundred volumes and pamphlets, comprising six hundred items, have been placed in our library. All of these have been fully catalogued, and listed, from time to time, in the Journal of the Garden.

"There are many rare works, much used in botanical study but difficult to secure. Many of the books are in fine bindings, and many of these bindings are nearly new. There are complete sets of many periodicals, which form the backbone of any scientific library. Nearly all of the standard works dealing with the classification of flowering plants are present, and the representation of floras, especially those of the old world, is very full. Rarities abound, and New York City is to be congratulated upon securing this important addition to its library resources."

Dr. P. A. Rydberg followed with a talk on "Some Extinct or Lost and Rediscovered Plants." The substance of this is being published in *Torreya,* the first part appearing in No. 6 of Volume 24 (1924).

HESTER M. RUSK,
Secretary pro tem.

PUBLIC LECTURES DURING MAY AND JUNE

The following is the program for the May and June lectures, to be delivered in the Museum Building of The New York Botanical Garden at 4 o'clock on Saturday afternoons. They will be illustrated by lantern slides and otherwise. Doors are opened at 4:15 to admit late-comers.

May 2. "Narcissi, or Daffodils," Mrs. Wheeler H. Peckham.
May 9. "Tulips," Mr. K. R. Boynton.
May 16. "Botanizing in the Colombian Andes," Dr. Tracy E. Hazen.
May 23. "Iris," Mr. J. C. Wister.
May 30. "The Rock Garden," Dr. E. B. Southwick.
June 6. "New Light on the Flora of the Old and New Testaments," Dr. Ephraim Ha-Reubeni.
June 13. "Java and the Javanese People," Dr. H. A. Gleason.
June 20. "What the World Drinks and Why," Dr. H. H. Rusby.
June 27. "Roses and their Culture," Dr. Marshall A. Howe.

NOTES, NEWS, AND COMMENT

Professor E. M. Gilbert, of the University of Wisconsin, visited The New York Botanical Garden in February, devoting some time to the study of the collections of the higher fungi.

Professor H. H. Whetzel, of Cornell University, spent several days during February at The New York Botanical Garden, looking over the collections of Porto Rican fungi in collaboration with our institution on the survey of the fungous flora of Porto Rico.

Mrs. Mary H. Holway, wife of the late E. W. D. Holway, recently visited the Garden to talk over matters relating to her husband's work. Mrs. Holway accompanied and assisted her husband on his last trip to South America, which resulted in bringing back large quantities of valuable fungi. We understand that these, especially the rusts, are to be carefully studied by experts in various groups, and the results published later.

Dr. John K. Small is making an extended study of the flora and floristics of parts of the Gulf States and Oklahoma and Arkansas. He plans to start at Cape Sable, Florida, and drive in a motor truck, through Florida, across Alabama, Mississippi and Louisiana, to El Paso, and back through Oklahoma and Arkansas. Dr. Edgar T. Wherry of the Bureau of Chemistry, U. S. Department of Agriculture, will be a member of the party. Other botanists will be associated with them from time to time as they proceed through the country.

The following visiting botanists have registered in the library during the winter months: Mrs. Rachel L. Lowe, Portland, Me.; Mr. Ivan M. Johnston, Gray Herbarium, Cambridge, Mass.; Prof. A. W. Evans, New Haven, Conn.; Profs. L. H. Bailey and H. H. Whetzel, Ithaca, N. Y.; Messrs. Geo. C. Potts, H. H. Tothero, and Wm. P. Miller, Harrisburg, Pa.; Dr. W. R. Taylor, University of Pennsylvania; Dr. Arthur P. Kelley, Rutgers University; Dr. Walter T. Swingle, Prof. R. Kent Beattie, Dr. Edgar I. Wherry, and Messrs. W. W. Eggleston and Thomas H. Kearney, Washington, D. C.; Prof. Bruce Fink, Oxford, O.; Prof. V. R. Gardner, East Lansing, Mich.; Prof. E. M. Gilbert, Madison, Wis.; Prof. J. Arthur Harris, Minneapolis, Minn.; Prof. J. E. Kirkwood, Missoula, Mont.; Mr. Edward N. Jones, State University of Iowa; Dr. J. J. Taubenhaus, College Station, Texas; Prof. H. M. Hall, Berkeley, Calif.; Prof. James McMurphy, Stanford University, Calif.; Prof. Philip A. Munz, Claremont, Calif.; Prof. C. D. Howe, University of Toronto; Dr. Mel T. Cook, Rio Piedras, P. R.; Mr. Carlos E. Chardon, San Juan, P R.; Dr. Arthur Brozêk, Charles University, Czechoslovakia, and Dr. Ephraim Ha-Reubeni, Jerusalem.

Dr. Arthur Hollick is on leave of absence from The New York Botanical Garden until July 1, during which period he will be located in Washington, D. C., continuing his work on the fossil flora of Alaska in connection with the U. S. Geological Survey. This work, as originally planned, was practically completed a year ago, but its scope was extended so as to include a considerable amount of new material collected by parties in the field during the preceding and current years.

Mr. Walter Charles, Museum Custodian, died suddenly on March 3. Mr. Charles had been a faithful and efficient employee of The New York Botanical Garden for nearly twenty-five years. He succeeded to the position of custodian of the museum building on the death of Col. F. A. Schilling in November, 1923.

Meteorology for February. The total precipitation for the month was 2.69 inches, only slight traces of which fell as snow. The maximum temperatures recorded for each week were 52.5° on the 6th, 52.5° on the 11th, *65° on the 22nd,* and 49.5° on the 24th. The minimum temperatures were 13° on the 3rd, 24° on the 13th, 21° on the 19th, and *12° on the 28th.*

Meteorology for March. The total precipitation for the month was 4.30 inches, of which a trace fell as snow. The maximum temperatures were 62.5° on the 7th, 67° on the 14th (interpolated), 70° on the 19th and *72° on the 26th.* The minimum temperatures were *11° on the 3rd,* 27° on the 13th (interpolated), 29° on the 21st and 26° on the 24th.

ACCESSIONS

BOOKS PURCHASED FROM THE GENEVA BOTANICAL GARDEN, AUGUST, 1923 (CONTINUED)

AGARDH, JAKOB GEORG. *Analecta algologica; observationes de speciebus Algarum minus cognitis earumque dispositione.—Continuatio 1–5.* Lundae, 1892–99.

Amsterdam—Akademie van wetenschappen. Jaarboek, 1877–91. Amsterdam, 1878–92.

Annals of the Royal botanic garden, Calcutta. Vols. 1–10. Calcutta, 1887–1905.

BALFOUR, ISAAC BAYLEY. *Botany of Rodriquez.* [London, 1878.]

BARBOSA RODRIGUES, JOÃO. *Plantas novas cultivadas no Jardim botanico do Rio de Janeiro.* 6 parts. Rio de Janeiro, 1891–98.

BISCHOFF, GOTTLIEB WILHELM. *Die kryptogamischen Gewächse mit besonderer Berücksichtigung der Flora Deutschlands und der Schweiz.* Lief. 1–2. Nürnberg, 1828.

BONNIER, GASTON EUGENE MARIE. *Le monde végetale.* Paris, 1907.

BONNIER, GASTON EUGENE MARIE, & LECLERC DU SABLON, ALBERT MATHIEU. *Cours de botanique.* Vol. 1; Vol. 2, fasc. 1–4. Paris, 1905.

BOULAY, NICOLAS JEAN. *Revision de la flore des départements du nord de la France.* 3 fasc. Lille, 1878–1880.

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N. L. BRITTON

EUROPEAN INFLUENCES IN AMERICAN BOTANY
JOHN HENDLEY BARNHART

CAMPING AND COLLECTING IN CHILE
GEORGE T. HASTINGS

PLANT CANCERS
MICHAEL LEVINE

SPRING FLOWERS IN THE BOTANICAL GARDEN
PERCY WILSON

NOTES, NEWS, AND COMMENT

ACCESSIONS

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BOTANY AND HORTICULTURE OF PORTO RICO AND THE VIRGIN ISLANDS

TO THE SCIENTIFIC DIRECTORS OF THE NEW YORK BOTANICAL GARDEN:

Gentlemen: Pursuant to permission given by you and by the Board of Managers, I was engaged in supplemental studies of the plants of Porto Rico and the Virgin Islands from the latter part of January to the early part of April, 1925, accompanied and assisted by Mrs. Britton and by Mr. Kenneth R. Boynton, Head Gardener. We sailed from New York for San Juan January 22d and returned on April 13th, traveling both ways on the steamship *San Lorenzo,* of the New York and Porto Rico Steamship Company; we are indebted to officials of that company and to officers of the ship for kind attention, facilitating the care of our large scientific collections.

There has recently been much activity in the experimental introduction of exotic plants into Porto Rico, St. Thomas, and St. Croix, including many economic and ornamental species not previously grown anywhere in the West Indies. Especially noteworthy in this important work have been the efforts of Mr. Otis W. Barrett, Agricultural Advisor of the Porto Rico government, and the establishment by him of an extensive plant propagation station at Trujillo; large additions to the highly important collections at the United States Agricultural Experiment Station at Mayaguez, through the work of Mr. D. W. May, Director, and of Mr. T. B. McClelland, Horticulturist; numerous valuable experiments in the introduction of trees for forestry purposes at

the nurseries of the Porto Rico Forest Service at Rio Piedras, in charge of Mr. W. P. Kramer, Chief Forester, and his assistants, Messrs. C. L. Bates and D. V. Brush; the continued increase and development of the collection of Mr. Arthur S. Fairchild at Louisenhöj, St. Thomas, now the most extensive and important private one in the West Indies; additions to the species grown at the St. Croix Agricultural Experiment Station in charge of Mr. J. B. Thompson, Director, and at the Insular Experiment Station at Rio Piedras, Porto Rico, in charge of Mr. Francisco Dominguez Lopez, Director, and Mr. J. P Griffith, Horticulturist; the estate of Mr. Harold I. Sewall and Mrs. Sewall at Naguabo, with its fine collection of Garcinias, its gigantic Pride of India tree (*Melia*), and its avenue bordered by enormous trees of *Enterolobium cyclocarpum,* these having formed trunks three feet in diameter, only about fourteen years old from seed; the garden of the Misses Noble at Condado, in which we observed luxuriant plants of *Byrnesia Weinbergi,* of the Stonecrop Family, a decorative thick-leaved species, and one of the very few members of that family which is suited to humid tropical conditions; the extensive commercial nursery of the Porto Rico Pineapple Company in charge of Mr. F. M. Pennock at Sabana Llana; the unique garden of Mr. Antonin Nechodoma at Monteflores; the old tree collection at Villa León near Bayamon, Porto Rico, through the courtesy of Messrs. Murphy and Clark, and the gardens of many other citizens and residents, in which rare trees and shrubs have been established.

This work in experimental tropical horticulture and silviculture has provided an unsurpassed opportunity for the observation of many kinds of plants hitherto unknown to us, or known to us only from greenhouse cultivation. Through gift and exchange, Mr. Boynton obtained cuttings and seedling plants of many species desired for our own collections, and seeds of more than 150 others. These nurseries and gardens also supplied records and descriptions of numerous species for the "Descriptive Flora of Porto Rico and the Virgin Islands," now in course of publication by the New York Academy of Sciences, as a part of the "Scientific Survey of Porto Rico and the Virgin Islands."

Studies of the native plants for use in this "Descriptive Flora" led us widely afield in search of rare or little-known species, espe-

cially in some of the few remaining areas of natural forest in Porto Rico, with valued aid from officials of the Forest Service and from Hon. Carlos E. Chardon, Commissioner of Agriculture and Labor, who guided us to a most interesting series of low forested limestone hills on the Hacienda Esperanza, near the northern coast in the vicinity of Barceloneta where the accumulation of leaf-mould was unusually thick, and where we saw one of the very largest individual trees existing in Porto Rico, a kind of Jaguey or Wild Fig (*Ficus Stahlii*) with a massive trunk over six feet in diameter, a height of perhaps eighty feet, and a spread of stout branches somewhat greater than its height; this elegant specimen stands on the forest margin, at the foot of a hill, just above a large spring of cool clear water, actually the mouth of a subterranean stream, an *ojo de agua*; these underground water courses are frequent in the limestone regions of northern Porto Rico, streams of considerable volume in some instances disappearing, and emerging at lower elevations at points several kilometers away.

As guests of Señor Eugenio Carlos de Hostos and Señora de Hostos, we visited their forest lands at Algarrobo, the nearest natural forest to the city of San Juan, in which we had previously made some studies, and where a fine tree may be seen of Tabanuco, one of the tallest and most majestic forest trees of Porto Rico, exuding a fragrant resin.

Mr. Boynton made the ascent of Monte El Yunque for three days' further studies of the elegant rain-forest of the Luquillo Mountains, with a party of entomologists, guided by Mr. Bates, of the Forest Service; the mountain maintained its reputation as the wettest part of Porto Rico, but important collections were brought down. Wooded ravines, with brooks near Corozal and Morovis, yielded, among other plants, specimens of beautiful and interesting ferns, desired for the studies of Dr. W. R. Maxon, of the United States National Museum at Washington, who is writing the part of the "Descriptive Flora" covering the ferns and fern-allies; other ferns were found in wooded gullies near Cidra and Las Cruces, to which we were guided by Professor H. C. Clum, of the University of Porto Rico, and Mrs. Clum, and still others in a delightful forest on limestone along the very wonderful new road south of Florida. At all these wild ferneries, Mrs.

Britton found mosses and brought away specimens to aid her in the preparation of manuscript for the moss part of the "Descriptive Flora," as also specimens of liverworts for study by Professor Alexander W. Evans, of Yale University.

We made some studies in the vicinity of Coamo, revisiting a relatively dry region in which we had spent much time in previous years, and observed with interest that the unusually abundant rainfall of the past autumn had given it a luxuriance greater than we had seen there before. Through arrangements kindly made for us at Ensenada on the southern coast by Mr. French T. Maxwell, Manager of the South Porto Rico Sugar Company, and Mrs. Maxwell, we spent several days in the desert region of Porto Rico, and collected specimens of many characteristic plants found only in this very dry district, including the Narrow-leaved Maranguey (*Zamia portoricensis*), a fine Cycad, the fruiting cones previously unknown to botanists, obtained through the aid of Don Livorio Troche. At Ensenada we revisited Mrs. Maxwell's beautiful garden, in its setting of coconut palms.

Through the kind hospitality of Don Adriano Gonzalez and Señora Gonzalez, of Arecibo, we were enabled to make renewed search for a rare *Eupatorium* on the steep limestone hillsides between Arecibo and Lares, where a fragmentary specimen of the plant had formerly been obtained, successful in so far as finding many bushes, disappointing, in none of them being in flower. On this occasion we also called on Don Narciso Rabell, of San Sebastian, a diligent student and collector of the fossils occurring abundantly in the rocks of this region, some of the strata rich in fossil plants, the investigation of which may be very important in adding to our fragmentary knowledge of the Tertiary ancestors of existing West Indian vegetation. At Arecibo we also enjoyed the hospitality and companionship of Don Andres Oliver and Señora Oliver who have rendered notable aid in the geological work of the Scientific Survey.

The progress of reforestation in Porto Rico, through the efficient operations of the Forest Service, was observed with high appreciation; this necessary work, on which a good commencement has now been made, has obtained widespread interest and support during the administration of Governor Horace M. Towner, whose recent recommendations for its further develop-

ment are of great value; from the nurseries of the Forest Service at Rio Piedras, an average distribution of over two thousand young trees is being effected daily; highly important experimental work in dendrology is there being prosecuted, and measures are being considered for the expansion of these nurseries, the establishment of an arboretum, and the addition by purchase of mountain lands for additional forest reserves.

The rescue from extermination of valuable endemic forest trees which have become very rare is also engaging the attention of the Forest Service; two notable examples of such rarity are of especial interest and importance. Cobana negra (*Stahlia monosperma*) of the Cassia Family was formerly widely distributed in the eastern and southern coastal districts, but search for it in recent years has been fruitless; its nearly black wood is highly valued for furniture, but during our visit the Forest Service was informed of the existence of a tree on the southern coast, then in fruit, from which several hundred seeds might be obtained, and measures were immediately taken to secure them. Besides its economic value, this tree is of particular interest to Porto Ricans, for its generic name commemorates Dr. Agustin Stahl, their most distinguished naturalist, who resided for many years at Bayamon. The other endemic tree verging on extinction is Caracolillo, or Hueso, or Violet-tree (*Phlebotaenia Cowellii*) of the Gay-wings Family, with hard, nearly white wood, producing myriads of small violet flowers, which completely cover its twigs and usually unfold while the tree is leafless or nearly so, doubtless the most elegant native flowering tree of Porto Rico, now known only as isolated individuals or small colonies in widely separated regions. From one of these colonies near Arecibo, Professor H. C. Cowles, of the College of Agriculture and Mechanics Arts at Mayaguez, hopes to obtain ripe seed this season, and the Forest Service has a tree under observation near Coamo Springs.

Reforestation of the Virgin Islands has not yet been attempted, but it is greatly needed on the higher hills of St. Thomas and St. Croix, and the existing forests on St. Jan are being reduced. On St. Thomas we visited several interesting districts with Mr. Arthur S. Lindborg, Director of Education, and his family, including Coki Point on the eastern coast, an important geological locality where the Cretaceous limestone outcrops and where we

were fortunate in finding in it some well-preserved fossil mollusks, which will be of value in the studies of Professor Howard E. Meyerhoff, of Smith College, who spent last winter studying the geology of the Virgin Islands and who is now writing the volume upon this geology for the Scientific Survey. On St. Thomas we enjoyed interesting consultation with His Excellency, Governor Philip Williams, U. S. N.; Rev. A. B. Romig, of Nisky, and Mr. H. Nies, of Bluebeard's Castle. I was much interested to learn that some progress is being made in improving the roads of St. Thomas. A good road system worked out over the existing bad roads, locally modified, can not fail to be of great importance in the future of that island. At present the roads traversable by motor cars are limited to a few miles with good surfaces. Provision for motor-car traffic over twenty-five or thirty miles would offer a series of wonderful, unsurpassed views of islands and of sea, would stimulate agricultural operations and would operate in many other ways for the welfare of the people and the attraction of visitors and of tourists. Inasmuch as abundant excellent road-metal is at hand, the expense should not be very great and a few miles might readily be built yearly.

Respectfully submitted,

N. L. BRITTON,
Director-in-Chief.

EUROPEAN INFLUENCES IN AMERICAN BOTANY[1]

In considering European influences in the history of American botany, we may disregard the pre-Columbian era; for although the early Norsemen recorded meager facts about the useful plants of their Vinland, several of the plants mentioned in the sagas have never been reasonably identified until an American botanist published a discussion of the subject only a few years ago. We must begin, however, with the earliest period of the later European discovery.

Six days after landing on San Salvador, Columbus wrote: "all the trees are as unlike ours, as day is to night, and so are the fruits, and so the plants." On his first voyage, Columbus was

[1] The text of an illustrated lecture delivered in the Museum Building of The New York Botanical Garden, April 18, 1925.

handicapped by the loss of one of his three small ships, and it does not appear that he attempted to carry back to Europe very much in the way of cargo; but on his second voyage he was much better equipped, and sent home in considerable quantity samples of the vegetable productions of the newly found lands. Other explorers followed his example, and as early as 1526 was published a small work in Spanish, by Oviedo, containing a chapter on the plant products of the so-called Indies, both the islands and the mainland. This has been reprinted, but the original is so scarce that it has never been my good fortune to see a copy of it.

Oviedo's first publication was followed by various other works of a similar nature, and within a hundred years perhaps twenty books had appeared containing accounts of American plants. Of course the science of botany, as we now know it, did not then exist, but more or less accurate descriptions were written by travelers, specimens were brought home and placed in the hands of the scientists of the day, and in many instances the plants themselves were brought into cultivation in Europe, and thus made more familiar than many even of the native European plants. It is impossible to estimate how great an impulse the introduction of these foreign novelties may have given to the development of interest in the study of plant life. Be that as it may, it is certain that the earliest workers who were instrumental in establishing the new science were acquainted with many American plants.

The earlier explorers of the New World devoted their attention, for the most part, to the tropical regions, and the earliest settlements were established there; consequently many plants of tropical America became known to Europeans earlier than those of the temperate regions. We shall consider first, however, the influence of Europe upon the botany of our own part of America.

The first work relating specifically to the flora of North America north of Mexico was that on Canadian plants by Cornuti, a Frenchman. It was published in 1635, less than thirty years after the first permanent settlement in Canada. It was not devoted exclusively to the plants of the new world, but the name of Canada occupies a conspicuous place on its title-page, and a number of our northeastern plants were described and figured for the first time. The one here shown, *Asaron canadense*, bears almost exactly the same name as that by which it is known today. Cor-

nuti, it would seem, was never in Canada—at least, if he was, he does not say so—and he fails to tell us how he became acquainted with the Canadian plants described and figured by him. We do not know, therefore, who supplied him with the materials for his work. His book was published twenty-five years before the birth of Michael Sarrasin, the first Canadian resident botanist whose name has been preserved; the man for whom was named the curious pitcher-plant or side-saddle flower, *Sarracenia.*

Parkinson, an English contemporary of Cornuti, was familiar with many plants from the English colonies on the North American mainland. In the first edition of his "Paradisus terrestris," issued in 1629, only about twenty years after the first settlement at Jamestown, he described many plants from Virginia. In his "Theatrum," published in 1640, he mentions many more from Virginia, and some from New England, where the Pilgrims had landed only twenty years before. As in the case of Cornuti, Parkinson failed to explain the source of his American material. Much of it doubtless came to him indirectly, but he does mention the name of one John Newton, who brought him from New England living material of the cardinal flower (previously known to him from Canada), and says that from the earth clinging to its roots grew other New England plants.

In 1672 there appeared in London the first account of the natural products of New England. This was by John Josselyn, and contained a chapter devoted to plants, as did also his account of two voyages to New England, published a few years later.

The famous English botanist John Ray seems to have been familiar with many North American plants, and from his "Historia plantarum" of 1686 it appears that he had many of them under cultivation at Cambridge. Among the appendices to his great work he placed the list of Virginia plants sent to him in 1680 by John Banister.

A contemporary of Ray in his later years was James Petiver, a London apothecary, who maintained an extensive museum of natural curiosities of all kinds. From time to time he published lists of accessions and desiderata, and he was always very scrupulous to acknowledge all gifts in the names of the donors, often adding the then highly complimentary remark that the giver was a very "curious" person, meaning of course that he was of a very studious nature.

In this way we learn the names of perhaps a dozen men who sent North American plants to Petiver, but in most cases we know little of them but their names, and in some instances it is not clear whether the donors had collected the plants themselves or had received them from some friend who had traveled or resided in America. One of them, however, was the Reverend Hugh Jones, who spent the most of a long life in the Maryland colony, and another was William Vernon, also of Maryland, for whom it is taken for granted that Schreber named the genus *Vernonia.*

Mark Catesby, an English naturalist, spent most of the years from 1712 to 1726 in Virgina, the Carolinas, Georgia, Florida, and the Bahama Islands, and upon his return to England published his great work on the natural history of this region, with descriptions and beautiful colored plates of many of the plants as well as the animals.

John Clayton, a Virginia colonist, sent many plants with their descriptions to Gronovius, a Dutch botanist, who published them in 1739 and 1743, with his own more or less stupid annotations and corrections.

We come now to the time of Linnaeus, the great Swedish naturalist, whose work of reducing botanical knowledge to a systematic form produced such a profound impression upon his contemporaries and successors that he has often been styled the "father of botany." His "Species plantarum," in which he first used consistently the system of binary names for plants, and in which he undertook the enumeration and brief description of all species of plants then known, was published in 1753; this work contains North American plants in considerable numbers. His knowledge of them was derived chiefly from the writings of his predecessors and from plants in cultivation in Europe, but also in no small measure from his American correspondents, such as Dr. Alexander Garden, of Charleston, S. C.; Dr. John Mitchell, of Urbanna, Va., and Dr. Cadwalader Colden, of New York. He was indebted even more largely to the collections of his compatriot and pupil, Kalm, made during his American travels for the few years immediately preceding the publication of the "Species plantarum." Kalm's name is commemorated in the genus *Kalmia,* our beautiful mountain laurel, and in various species, such as the delicate *Lobelia Kalmii.*

When we consider that the collections upon which were based the published works of Ray, of Petiver, of Catesby, of Gronovius, and of Linnaeus are all preserved in England, chiefly at the Natural History Department of the British Museum, we can readily understand something of the influence of *England* upon the history of *North* American botany.

From 1753 until the death of Linnaeus twenty-five years later, very little progress was made in the knowledge of North American plants; but soon after this there appeared the first botanical work published in this country, a small volume by Humphry Marshall, and from this time onward the number of American botanists and botanical publications slowly but steadily increased. The most important work on North American botany, however, continued to be done by Europeans. The first work in which an attempt was made to describe all the known plants of North America was the flora by Michaux, issued at Paris in 1803. This was based almost wholly upon the collections made by Michaux during his years of travel, from Hudson Bay to Florida, and his herbarium, still preserved at the museum of natural history in Paris, is full of interest to the American botanist of today. Michaux's son, who had also spent much time in America, published a few years later his monumental work on the North American forest trees.

The flora of Michaux was followed about ten years later by that of Pursh, a German botanist who had spent nearly twelve years in making collections here; he utilized, however, not only his own collections, but various others placed at his disposal in England, where his work was prepared and published.

The works of Michaux and Pursh were the standard floras of North America for many years; that of Michaux was more reliable, but that of Pursh was more complete. Meanwhile numerous residents of this country were devoting attention to botany, and European influence was destined to become a matter of history rather than of current fact. Hooker's great work on the flora of British North America, issued in parts at intervals from 1829 to 1840, was the last important contribution of a European botanist to the literature of North American botany, at least as far as flowering plants are concerned.

This fact is chiefly due to the influence of John Torrey, of New York, and his younger associate, Asa Gray. In 1838, they began

together the publication of a flora of North America which should supersede those of Michaux and Pursh, and the less pretentious work of Nuttall. By the careful studies of the junior author in the old herbaria of Europe, and of both upon the abundant material pouring in upon them from the new west between the Alleghanies and the Rockies and from the Pacific coast, they were able to place our knowledge of North American plants upon a secure basis. The new western material accumulated so rapidly, however, that they were obliged to give up their flora when it was still far from complete, and to devote all their available time to the study and description of the material received; otherwise the numerous new species would have been described in large part by European workers, and the authentic material preserved in European herbaria. So well did Torrey and Gray, and their American associates, accomplish the task they thus deliberately set before themselves, that for the past seventy five years no important contribution to the knowledge of the North American flora has emanated from a European source. The only influence exerted upon North American botany by any living European botanist has been his personal influence upon his American co-workers.

The history of botany in America south of the southern boundary of the United States, however, has been very different. Resident botanists have never been numerous anywhere in this vast region, and the extremely rich flora of tropical America and of extra-tropical South America has been exploited chiefly by European students, from the discovery down even to the present day.

As we have already mentioned, the earlier explorers devoted their attention more especially to the region between the tropics, and the same is true of the more scientifically-minded writers who first published reliable technical descriptions of American plants. After Oviedo, the first writer who claims our attention is Monardes, whose " Historia medicinal," first published in 1569, was very popular in its day, as it was an attempt to describe the medicinal properties of the newly discovered products, and especially the plant products, of the new world. Within fifty years there had appeared not less than fifteen editions, three Spanish, five Latin, three English, three Italian, and one French. It was for this Monardes and another writer of the same name that Linnaeus named the genus of North American mints, *Monarda*.

In 1615 was published the first of several works relating to the botany of Mexico, by Hernandez, who had been sent to Mexico for study some thirty or forty years previously by Philip II of Spain, and had spent several years there. Neither the works of Monardes nor those of Hernandez are of any great scientific value, but they reflected and served to intensify the awakening interest of scientific Europe in American plants.

The works of Piso and Marcgrav, published together in one volume at Leyden, in 1648, and dealing with the medicinal products and general natural history of Brazil, contained the first account of importance of the flora of any part of South America; and the only other work of similar character, of pre-Linnaean date, is the journal of travels in South America, with an account of the medicinal plants of Peru and Chile, published by the Frenchman Feuillée in 1714 and 1725.

The actual botanical history of the West Indies begins with Charles Plumier, a French Franciscan friar, who made three voyages to the French islands during the closing years of the seventeenth century, prepared several hundred original drawings from nature of the plants of these islands, and published several books on the subject. Plumier's work, and that of Sir Hans Sloane, who was working and publishing at about the same time upon the flora of Jamaica, are both of abiding value.

There is a break of twenty-five years in the literary history of West Indian botany between the appearance of the last volume of Sloane and the works by Hughes on Barbados and by Patrick Browne on Jamaica. These two were essentially contemporary with the "Species plantarum" of Linnaeus, and were uninfluenced by it, but all subsequent works on the West Indian, Mexican, and South American floras have followed the Linnaean binomial system of nomenclature. The last half of the eighteenth century was a period of great activity in this field, and there are a number of writers, all Europeans, but of various nationalities, whose work requires special mention.

First in time, and of prime importance, was Jacquin, an Austrian botanist of Dutch birth, who spent four years in botanical travels throughout the West Indies and along the northern coast of South America, and whose sumptuously illustrated works have never been excelled. During the same half-century a Frenchman,

Aublet, published an extended account of the flora of French Guiana; Molina, an Italian by adoption although a Chilean by birth, wrote on the flora of Chile; Swartz, a Swede, spent three years in the West Indies and contributed very largely to the literature of their flora; Ruiz and Pavon, Spaniards, published their important works dealing with the flora of Peru, works which depend for their value wholly upon the labors of the Englishman Dombey, whose name occurs nowhere between their covers; and Vahl, a Dane of Norwegian birth, issued several works devoted to American plants collected and transmitted to him by his friends.

Just before the close of the century Humboldt and Bonpland started upon their famous journey of scientific exploration in tropical America, so full of significance for all branches of natural science, and particularly for botany, the published botanical results alone comprising not less than fifteen folio and quarto volumes.

Of the numerous European workers on the American flora during the nineteenth century and the few years that have elapsed since its close, we can undertake to mention but a few. Perhaps the most important is the German botanist Martius, who published numerous and sumptuous works upon Brazilian plants, and commenced the "Flora brasiliensis," the most elaborate flora of any country up to the present time. (In the temporary bindings in which it was issued, the cost of this work, to each subscriber, was more than a thousand dollars.) Auguste Saint-Hilaire, a French botanist, was also a very ardent student of the Brazilian flora, and contributed largely to its elucidation, as did Pohl, an Austrian.

The flora of Chile and Peru has been made known largely through the publications of the Englishman, Miers; the Italian, Colla; the German, Poeppig; the Frenchman, Gay; and the Anglo-Parisian, Weddell. The flora of Ecuador and Colombia is treated in works by Karsten and Jameson, while various Europeans have written upon the flora of the Guianas, among whom may be mentioned Meyer, Splitgerber, Schomburgk, Miquel, and Pulle.

The flora of the West Indies has been partially elucidated by such works as Ramon de la Sagra's great history of Cuba, and

Grisebach's flora of the British West Indian islands and catalogue of Cuban plants. For many years after the publication of Grisebach's works, the opinion seemed to prevail that the West Indian flora was so well understood as to present little further inducements to the investigator, and it is only in recent years that the field has been rediscovered as a particularly attractive one. Much work has been accomplished latterly by American botanists, but even in the present century there has been no more earnest and scholarly specialist in the flora of the Antilles than Urban, of Berlin.

In the development of Mexican and Central American botany, botanists from the United States have long taken a prominent part, both by the collection of material and its subsequent description. Most of the important work published, however, has been by European writers, such as the Englishmen, Bentham and Hemsley; the German, Seemann; the Belgians, Martens and Galeotti; and the Danes, Liebmann and Oersted. One of the most beautiful botanical works ever published is that on the Orchidaceae of Mexico and Guatemala, by the British author, Bateman.

Perhaps enough has been said to indicate how thoroughly the existing store of knowledge of the American flora has depended upon the studies and writings of European botanists. Of course it has been possible to mention only a few of the more important works and workers; if another had been making a choice of the same number, doubtless some of these would have been omitted and others would have taken their places. Yet the brief record here given is a representative one. It shows that a hand in the matter has been taken by scientists of England, France, Germany, Belgium, Holland, Denmark, Sweden, Austria, Italy, and Spain. It would have been easy to add to this list Russia, Norway, Switzerland, and Portugal, for nearly every important country of Europe has contributed investigators in this field.

And not only have Europeans done the work, but all of the vast collections upon which this work is based have gone to Europe, where nearly all of them are now preserved. They are scattered all over Europe, in private hands as well as in public institutions, and often in comparatively out-of-the-way places, and it is not always easy for a student of the American flora to find the actual specimens studied by the writer of one of the old

books, but as time has passed, the majority of them have become concentrated in and near a few of the largest cities, such as London, Berlin, and Paris. The most important collections are those of the natural history museums of London and Paris, and the British and German botanic gardens at Kew near London and at Dahlem near Berlin. Of course, in the study of the flora of the United States and Canada, it is now rarely necessary for the investigator to consult these European collections, for careful comparative work has been done, and well done, in the past; but as soon as we pass the southern boundary of the United States, we find European study absolutely essential to a proper understanding of American plants.

JOHN HENDLEY BARNHART.

CAMPING AND COLLECTING IN CHILE[1]

Chile is a land of contrasts: 2,700 miles long, it averages less than 90 miles in width. From the coastal plains and interior plateau, it rises to the summits of the high Andes. Though the north consists chiefly of one of the driest deserts of the world, the south boasts a tropical luxuriance. Cities with every modern device—radios, motor-driven street-cleaning machines, well-paved streets; small towns with nothing modern and streets impassable except on horseback. Wealthy and cultured upper classes, densely ignorant and wretchedly poor peons.

Near the cities the plants are chiefly cosmopolitan weeds. Along the country roads are lines of Alamos or Lombardy poplars, between which a wild blackberry often grows to a height of fifteen feet, and in damp places a tall slender horsetail, one of the fern allies, is sometimes found. Eucalyptus trees and oaks sometimes replace the poplars. Often the roads are lined only with high mud walls, built of adobe bricks, in which case they are as unattractive as a road well can be.

On the hills and mountain slopes are many species of plants that we know only in cultivation; verbenas, fuschias, and calceolarias, the latter with small flowers in large clusters, purple, red, yellow, or mottled. Tropaeolums of several species are common,

[1] Abstract of a lecture at The New York Botanical Garden, Saturday afternoon, March 28, 1925.

especially the dainty little climbing soldier plant, "soldadillo," with its tricolor flowers of red, white, and blue, in shape showing its close relationship to our cultivated nasturtium. Most of the shrubs in central Chile are thorny with small leaves or no leaves during the dry summer. Everywhere there are cactus plants, large or small. The large columnar cacti often have bright red masses of a leafless parasite, Loranthus, related to our mistletoe. Other species of Loranthus make great masses in the Alamos and other trees. Camping in the mountains is comfortable only near the brooks where trees and unarmed shrubs give agreeable shelter. On the higher slopes above the range of trees and bushes are many tussocks of spiny-leaved plants representing several different orders, but all of the same general structure. Hidden between the stones are tiny composites with daisy-like flowers and violets so small that a plant with a rosette of leaves and a half dozen flowers could be hidden under a quarter of a dollar.

The mountains in many places contain rich deposits of metal, copper especially. One of the largest copper mines is on the side of an extinct volcano. This mine, operated by an American company, has the most modern machinery and methods and profitably works ores of so low a grade that they were formerly discarded.

The southern extremity of Chile is a half-submerged mountain range, Smythe's Channel and the Straits of Magellan being drowned mountain valleys.

The lecture was illustrated with some seventy slides, mostly colored, showing something of the country in the north with the nitrate fields, the central portion with its irrigated farm lands, and the straits in the south. A series of views around one of the large mines showed a long flume made of California redwood used to bring a mountain brook to the power plant. Other views showed the characteristic vegetation of the lower mountain slopes and of the high ridges.

GEORGE T. HASTINGS.

PLANT CANCERS[1]

The Montefiore Hospital has not only provided the speaker with facilities for studying human and animal cancer but has

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, March 21, 1925.

made it possible for him to investigate the cancer-like growths of plants. The experiments initiated in New York have been undertaken by various scientists in Paris, Berlin, Copenhagen, and other centers of biological research.

The lecturer traced the history of human and of animal cancer. He pointed out the characteristics of this disease and compared them with the conditions found in plants. He mentioned some of the futile efforts that have been made to discover the cause and remedy for human cancer. He contended that the recent claims of the discovery of the cause of this disease are preliminary reports and lack adequate proof.

Plant tumors, known as crown galls, are often very harmful to plants. Certain types of these overgrowths are analogous to human and animal cancer. In general, they represent a type of growth which is an entity in itself. By way of proving these points, the speaker showed lantern slides of young apple trees, rose bushes, tobacco plants, geraniums, and beets, infected with tumor-like growths. He described the artificial production of tumors in plants. This consists of pricking the plants where the tumor is desired with a needle containing a culture of a tumor forming germ. Dr. Levine pointed out that while these plant cancers are not analogous to animal cancer, they form a type of disease which is of economic importance. Laws prohibiting the sale of plants infected with this disease are enforced in 44 states and provinces of the United States and Canada. Other economic plant diseases described were the potato wart and club root. These diseases are caused by other forms of microscopic organisms. According to the speaker, both are types of plant cancers.

Potato wart is relatively a new disease in America. The speaker explained that while this disease has been known in Europe since 1896, it was not until the potato shortage of 1911–1912 that diseased potatoes were introduced and were found in 1918 in the mining section of Pennsylvania. Club root of cabbage, turnips, radish, cauliflower, wild mustard, etc., was also described as a plant cancer. Lime, added to the soil, and rotation of crops are effective means of keeping this disease in check.

Since the discovery of X-rays and radium, efforts have been made to determine their value in the cure of malignant diseases. The influence of radium on these plant cancers was briefly de-

scribed. The object of these experiments on plant tissues was to understand better the influence of radium on human and animal cancer.

The more than 75 lantern slides included many plant tumors photographed under the microscope. Living cultures of the bacteria which produce the crown gall disease were shown; also, living geraniums and branches of rubber trees with plant cancers.

MICHAEL LEVINE.

SPRING FLOWERS IN THE BOTANICAL GARDEN

A list of the earlier spring flowers of the present year was published in the JOURNAL for April. Below are the plants that were noted as coming into bloom in the period between March 29th and April 12th:

March 29, Buffalo-berry (*Lepargyraea argentea*).
March 29, Dandelion (*Leontodon Taraxacum*).
March 29, Downy Rock-cress (*Arabis alpina*).
March 29, Fringed-leaved Saxifrage (*Bergenia ligulata*).
March 29, Yellow Bell (*Amblirion pudicum*).
April 1, Ash-leaved Maple (*Acer Negundo*).
April 1, Conrad's Broom Crowberry (*Corema Conradii*).
April 1, Periwinkle (*Vinca minor*).
April 2, Haller's Pasqueflower (*Pulsatilla Halleri*).
April 2, Moss Pink (*Phlox subulata*).
April 2, White-flowered Glory-of-the-Snow (*Chionodoxa Luciliae alba*).
April 2, Ground Ivy (*Glechoma hederacea*).
April 2, Spice-bush (*Benzoin aestivale*).
April 4, Thurber's Magnolia (*Magnolia Kobus*).
April 4, Hall's Magnolia (*Magnolia stellata*).
April 5, Early Rhododendron (*Rhododendron praecox*).
April 6, Lesser Celandine (*Ficaria Ficaria*).
April 6, Dutchman's Breeches (*Bicuculla Cucullaria*).
April 7, Azure Lungwort (*Pulmonaria angustifolia azurea*).
April 8, Fragrant Sumac (*Schmaltzia crenata*).
April 8, Oregon Grape (*Odostemon nutkanus*).
April 8, Yellow Adder's-tongue (*Erythronium americanum*).

April 8, Early Saxifrage (*Micranthes virginiensis*).
April 8, Crested Lungwort (*Pulmonaria saccharata*).
April 8, Mountain Cinquefoil (*Potentilla montana*).
April 8, Cut-leaved Toothwort (*Dentaria laciniata*).
April 9, Twin-leaf (*Jeffersonia diphylla*).
April 9, Bloodroot (*Sanguinaria canadensis*).
April 9, Shortia (*Shortia galacifolia*).
April 9, Catesby's Leucothoe (*Leucothoe Catesbaei*).
April 9, Single Hyacinth ("Sir William Mansfield").
April 9, Pansy (*Viola tricolor*).
April 10, Single Hyacinth ("King of the Blues").
April 10, Single Hyacinth ("Queen of the Whites").
April 10, Darwin Tulip ("Giant").
April 10, Darwin Tulip ("William Pitt").
April 10, Norway Maple (*Acer platanoides*).
April 11, Bluets (*Houstonia coerulea*).
April 11, Birds-foot Violet (*Viola pedata*).
April 11, Meadow Blue Violet (*Viola papilionacea*).
April 11, Japanese Rose-bud Cherry (*Prunus subhirtella*).
April 11, Sakhalin Cherry (*Prunus serrulata sachalinensis*).
April 11, Yoshino Cherry (*Prunus serrulata Yoshino*).
April 11, Avens Waldsteinia (*Waldsteinia geoides*).
April 12, Three-lobed Violet (*Viola triloba*).
April 12, Ovate-leaved Violet (*Viola fimbriatula*).
April 12, White-flowered Meadow Blue Violet (*Viola papilionacea alba*).
April 12, American Dog Violet (*Viola conspersa*).
April 12, Canada Violet (*Viola canadensis*).
April 12, Smoothish Yellow Violet (*Viola eriocarpa*).

PERCY WILSON.

NOTES, NEWS, AND COMMENT

Dr. J. C. Arthur, of Purdue University, Lafayette, Indiana, recently spent a few days at The New York Botanical Garden, conferring with the editor of *North American Flora,* regarding the publication of rust manuscript, which is nearly completed.

Hon. Carlos E. Chardon, Commissioner of Agriculture and Labor of Porto Rico, was a recent caller at The New York Botanical Garden. Mr. Chardon, a graduate of Cornell University, is a trained mycologist and is collaborating in the work of preparing a check list of Porto Rican fungi, which is to be published by the New York Academy of Sciences. The main object of his visit to the States was to look after details in connection with the proposed embargo on certain Porto Rican fruits.

Dr. A. B. Stout, Director of the Laboratories, returned in April to his work at The New York Botanical Garden after spending two months in southern Florida in a study of the flower behavior of avocados. This investigation was conducted in coöperation with the Florida Avocado Association, the Dade County (Florida) Farm Bureau, and the Bureau of Plant Industry, the latter represented in the field work by Mr. E. M. Savage and Mr. T. Ralph Robinson. While in Florida Dr. Stout addressed the Florida Avocado Association on "Flower Behavior of Avocados with Reference to Pollination," and he also gave an address on "The Clonal Variety in Horticulture" before the Florida State Horticultural Society at its thirty-eighth annual meeting.

In spite of the extensive campaign waged in Westchester County against the tent caterpillar this spring, resulting in the destruction of nearly two million egg clusters or about five hundred millions of caterpillars (see JOURNAL for April), the menace continues. The wild cherry trees along the Harlem Division of the New York Central Railway are already conspicuous with the tents of the young caterpillars which promise to be even more abundant and destructive than during the past season. Every possible effort should be made to destroy these tents with their occupants now, and later in the season an even more strenuous program should be adopted to rid this section of the pest by destroying the egg clusters during the closed season.

The Reverend Doctor Henry R. Rose, of Newark, New Jersey, gave an illustrated lecture on "Yosemite Valley and the Mariposa Grove of Big Trees" at The New York Botanical Garden on Saturday afternoon, March 7th. He showed seventy slides colored

artistically. One was of President Theodore Roosevelt and a group of naturalists at the foot of Grizzly Giant, the oldest living thing in the world. The tree is over 260 feet high and was young when the Pyramids were being built. A hundred United States cavalrymen were shown on one of the fallen trees, which contains lumber enough to make a box of a size to enclose the American liner "The Leviathan." An enormous driveway was shown through the very heart of the tree named "California," with an automobile standing in the center, indicating the vitality of these great trees. Many wild flowers were shown.

Nathaniel Harrington Cowdry died in New York City, 25 January, 1925. Born 20 September, 1849, at Torrington, in Devonshire, England, he was brought to Canada by his parents in 1854, and from early life until his retirement in 1913 he was a banker, connected with various Canadian institutions. He was the son of Thomas Cowdry, whose herbarium is at the agricultural college at Guelph, Ontario, and from boyhood he was interested in botany; his collections in the Canadian north-west, in 1882, are in the government herbarium at Ottawa. His son, Dr. Edmund Vincent Cowdry, was engaged in laboratory work in various institutions, and he took advantage of the opportunity to work in the same laboratories, at the University of Chicago, Johns Hopkins University, and Peking Union Medical College, from 1913 to 1920, upon mitochondria in plants; his results were published in several contributions to the *Biological Bulletin.* While in China, from 1919 to 1921, he collected many plants; those found about Peitaiho in the summer of 1919 were enumerated in the *Journal of the North China Branch of the Royal Asiatic Society.* His marine algae formed the subject of a paper by Dr. Marshall A. Howe, published in the *Bulletin of the Torrey Botanical Club* in 1924. Since coming to New York a few years ago he had spent such time as his health permitted in study of his Chinese plants at the herbarium of The New York Botanical Garden.

Dr. G. Clyde Fisher, Curator, American Museum of Natural History, gave an illustrated lecture under the title of "Across the Trail of Linnaeus in Arctic Lapland" at the museum of The

New York Botanical Garden on Saturday afternoon, April 11. Dr. Fisher, as the leader of an expedition to Arctic Lapland in 1924, recently returned with a wealth of interesting observations upon the life of the nomadic tribes and the natural history of this beautiful and little-known northland. The expedition crossed the Arctic Circle into northern Scandinavia late in June, 1924, and spent a month in the land of the Midnight Sun. Dr. Fisher and his companion, Mr. Carveth Wells, twice crossed Swedish and Norwegian Lapland through a wilderness not before traversed by any American or Englishman, making a splendid and unique pictorial record of the Lapps, both with still and motion picture cameras. They accompanied these sturdy nomads on their early summer migration with their reindeer, sleeping in their tents and eating their rude fare of reindeer meat, fish, and goat's milk. They visited the nomadic Lapp schools, and were entertained by Turi, the only Lapp who has written a book. Dr. Fisher described his wanderings over the Arctic heath, bright with wild flowers, his tramps through snow-fields, sometimes waist deep, and the ascent of Mt. Akka, with its great glaciers, perhaps the most commanding sight in Lapland. He showed many photographs of plants that were known to Linnaeus, the immortal "Father of Botany."

On Saturday afternoon, September 13, 1924, Dr. John Hendley Barnhart, Bibliographer of The New York Botanical Garden, delivered a lecture on "American Botanists of the Past" in the lecture hall of the Museum Building. His interesting talk treated of the lives of many well-known botanists, some of the foremost of these being John Clayton, John Bartram, Humphrey Marshall, and John Torrey. John Clayton came from England to settle in Virginia and made extensive studies of the flora of that state. John Bartram, a Quaker, and the first native American botanist, was born near Philadelphia in 1699 and, though only slightly known by his publications, he is remembered by present-day botanists because of his letters to Collinson and Gronovius, the famous European botanists of his day. John Bartram will be remembered as having established the first botanic garden in America, near Philadelphia, about 1730. William Bartram, the son of John, continued the fine work of his father, wrote several ac-

counts of his travels in the southern Atlantic states, and maintained, until his death, the botanic garden in which his father had taken such pride. Several years later this garden became the property of the city of Philadelphia and is now a city park. The second American botanic garden was also near Philadelphia, established in 1733 by Humphrey Marshall. This old garden is no longer in existence but the old house, built by Marshall with his own hands, is still in an excellent state of preservation. Humphrey Marshall has the distinction of having written the first botanical work ever published in the United States, an account of our native trees and shrubs. The lecturer then made mention of Dr. John Torrey, who won renown through the publication of a long list of important works. His admirers founded in his memory, the Torrey Botanical Club, the members of which were in-

al in the establishment of The New York Botanical Gar-

and the erection of the building in which this lecture was

ed. The lecturer closed with the following remarks: "The day of usefulness of amateur work in botany, such as that of Frost and of Williamson, has not passed. The limits of our topic forbid the mention of the names of the living, but even now there are farmers, and merchants, and professional men, who by devoting their leisure moments to serious study are notably advancing botanical science."

ACCESSIONS

MUSEUMS AND HERBARIA

20 specimens of fungi, "Fungi Wisconsin[illegible] Exsiccati," decades 11–13. (Given by Dr. J. J. Davis.)

26 specimens of fungi, "Fungi Dakotens[illegible] (Distributed by Dr. J. F. Brenckle.)

200 specimens of fungi, "Mycothe[illegible]carpatica." (Distributed by Dr. F. Petrak.)

2 specimens of cup-fungi from California. (By exchange with Professor T. H. Macbride.)

200 Specimens of fungi, "North American Uredinales," centuries 32, 33. (Distributed by Mr. Elam Bartholomew.)

154 specimens of fungi from various localities. (By exchange with Professor Bruce Fink.)

371 specimens of fungi from Porto Rico. (By exchange with Cornell University.)

1 specimen of fungus, *Trichoderma paradoxum,* from Japan. (By exchange with Dr. C. G. Lloyd.)

51 specimens of fungi from Porto Rico. (By exchange with Professor Bruce Fink.)

224 specimens of fungi from tropical America. (By exchange with Professor F. L. Stevens.)

30 specimens of fungi from Porto Rico. (By exchange with Professor Bruce Fink.)

79 Arctic specimens of flowering plants. (By exchange with the National Herbarium of Canada.)

24 specimens of flowering plants from Mexico. (By exchange with the National Museum of Mexico.)

200 specimens of flowering plants from Minnesota and Wisconsin. (By exchange with the University of Minnesota.)

14 specimens of flowering plants from Chappaquiddick Island. (Given by Dr. A. Hollick.)

9 specimens of flowering plants from Iowa. (Given by Mr. B. D. Walden.)

340 specimens of flowering plants from Arizona and New Mexico. (By exchange with the Bureau of Plant Industry, Washington, D. C.)

41 specimens of flowering plants from Alberta, Canada. (By exchange with Mr. N. B. Sanson.)

8 specimens of marine algae from Jamaica, B. W. I. (By exchange with Academy of Natural Sciences, Philadelphia.)

8 specimens of Anthocerotaceae. (Given by Professor D. H. Campbell.)

5 specimens of *Gracilaria lacinulata* from Florida. (Given by Mr. Paul Mitchell.)

187 specimens of marine algae from Dry Tortugas, Florida. (By exchange with Dr. Wm. Randolph Taylor.)

3 specimens of marine algae from Japan. (Given by Mr. S. Narita.)

1 specimen of *Plagiochasma rupestre* from Mexico. (By exchange with the U. S. National Museum.)

52 specimens of Swedish marine algae. (By exchange with Mr. W. N. Ryström.)

2 specimens of *Batrachospermum* and 1 specimen of *Lemanea* from Virginia. (By exchange with U. S. National Museum.)

459 specimens of flowering plants from Ecuador. (Purchased from Louis Mille, S.J., 1925.)

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Bronx Park, New York City

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THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

VOL. XXVI JUNE, 1925 No. 306

JOURNAL

OF

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ACCESSIONS

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JOURNAL
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FIRST BLOOMING OF THE DAFFODILS

The planting of nearly 50,000 daffodils on the slope south and east of the Iris Garden has resulted in a display quite adequate for the first year of bloom. The planting consists of three major portions, the first a band of one hundred and thirty varieties in small groups, arranged according to type, the second a massed planting in thousand lots of trumpets or some of the more robust kinds, and the third a naturalistic planting of the kinds suitable for half-shade or for grass.

Passing along the systematic planting, the first new yellow trumpet to attract attention was Cleopatra; Candlestick and Tresserve also surprised us. Herbert Smith, Henry Ford, John Farquhar and one or two others were also new to many daffodil-lovers. Among the bicolor trumpets some thought Robert Sydenham best, others still preferred Weardale Perfection. Spring Glory was the earliest of this section and Sulphur Beauty the palest and shortest but one of the most attractive.

The Garden has hardly been able to show a good white trumpet daffodil for fifteen years, but the new collection contains nine varieties, Alice Knights, Jacoba, Loveliness, Mme. de Graff, Mrs. Ernest Krelage, Mrs. Robert Sydenham, Peter Barr, Wm. Goldring, and the little W. P. Milner. Some beautiful Incomparabilis varieties are Edrin, a broad yellow one with slightly folded perianth segments, Bernardino, Homespun, Frank Miles, Holbein, and Whitewell. Near the road are some fine varieties of the Barrii, Leedsii and Poeticus types. Of the Giant Leedsii type,

[illegible] Narcissus collection, [illegible] New York Botanical Garden, April 25, 1925

along the Douglas Spruce memorial plantation, some eight varieties were shown, including Sirdar, Crystal Queen, Her Grace, and Lord Kitchener. Near the upper end of this border the new Golden Sceptre, a hybrid between the jonquil and a yellow trumpet daffodil, attracted much attention. It is a short miniature yellow trumpet, of rich golden-yellow color.

The new mass plantings of the trumpets Spring Glory, King Alfred, Martha, Glory of Sassenheim, Sulphur Beauty, and White Queen, Beauty, and Sir Watkins, made heavy masses of yellow and white bloom, which Mrs. Wheeler H. Peckham designed to be the base planting out from which the naturalized drifts of Poeticus, Barrii, Incomparabilis, and others would range.

FIGURE 2. A view of a part of the Narcissus planting, April 23, 1925

These drifts of Poeticus varieties toward Pelham Ave., Poeticus, White Lady, and similar varieties toward Fordham Hospital, Sir Watkins, Frank Miles, Evangeline, Glory of Lisse, and others toward the east, with a bright Glitter, Firebrand, or some other strong-eyed sort mixed in, were, for the first year, remarkably natural or informal, as if placed there by nature. Mrs. Peckham is not quite satisfied with some of the points, and plans to extend the work further this fall.

KENNETH R. BOYNTON.

PORTO RICO AND THE AMERICAN VIRGIN ISLANDS[1]

This lecture was based on a recent exploring expedition to Porto Rico and the Virgin Islands, the trip having been made at the request and as the guest of the Porto Rican government. While a major portion of the time was spent in Porto Rico, in some ways the most interesting part of the expedition was the visit to the American Virgin Islands, first, because these islands have so recently come into the possession of the United States, and, secondly, because no American mycologist had before touched these islands, although several Europeans had previously worked here. About fifty per cent. of the fungi collected were previously unknown to the islands.

The Virgin Islands

The Virgin Islands were discovered by Columbus in 1493 and so-named by him on account of their numbers in allusion to the Roman legend of the 11,000 virgins. His first landing was made on St. Croix, found to be inhabited by Indians which were called Caribs because of the grewsome evidences of their cannibalistic tendencies (hence Caribbean Sea). This group of islands is located about forty miles from the eastern end of Porto Rico, and in connection with our work on the study of the flora of Porto Rico it was decided to spend two weeks on the American Virgin Islands, which comprise those formerly known as the Danish West Indies and recently purchased from Denmark. The three largest ones are St. Thomas, St. Croix, and St. Jan.

Leaving Porto Rico late in the evening, after a night's ride on the little steamer "Marina" we arrived in the beautiful harbor of St. Thomas just as the day was beginning to dawn. The quiet town nestling in the foothills of the mountains which rise quite abruptly from the shore, with her ships peacefully at anchor i the harbor, presented a picture not easily forgotten and scarcely to be excelled in the beauty of its natural scenery.

The island is about thirteen miles long and three or four miles wide and is for the most part mountainous, the peaks rising to an elevation of 700–1,400 feet. There are no extended automobile

[1] Abstract of an illustrated lecture given in the Museum of The New York Botanical Garden on Saturday afternoon, April 4, 1925.

roads and many parts of the island can be reached only on foot or by horseback.

As in most West Indian islands, the heat, which would otherwise be intense, is tempered by the everblowing tradewinds. The daily variation is only about nine degrees, so that on the whole the heat is not oppressive. The place is almost entirely denuded of forests and although the rainfall is about equal to that of our own region (New York), this is not sufficient for successful agriculture. The lay of the ground is such also that the rain runs off rapidly, leaving the hillsides parched and dry.

The residents of St. Thomas as well as the other Virgin Islands are mostly colored but it is a welcome surprise to an American coming from Porto Rico, where Spanish is commonly spoken, to find English the prevailing language and this in spite of the fact that the place has been under Danish rule many years (since 1666). The accent, however, is so unusual that one must listen closely to get the words, and the dialect varies greatly in the different islands.

As our ship enters the harbor, one of the most conspicuous objects just outside of the town and on a high hill is a truncated tower looking like a windmill tower deprived of its wings. And doubtless it was once a windmill tower, perhaps used in the grinding of sugar cane at a time when the island had a fertile soil, before it had been deprived of its forests. The tradition, however, persists that it was once a pirates stronghold and that Blackbeard himself, the pirate with the whiskers and the seventeen wives, held forth there for a time. Near it, in another direction, is a similar structure known as Bluebeard's Tower, which is believed to have been used for a similar purpose.

The most important feature about the Island of St. Thomas, and, in fact, the one for which it was purchased, is its wonderful harbor, almost enclosed by land and so sheltered that ships up to the number of 200 may be harbored here at one time. In time past, St. Thomas was a port of call and ships visited here from every part of the world. It was also a great coaling station, but as oil has replaced coal this industry has declined. As a result the people are very poor, since about the only industry left is the picking of bay leaves and the distilling of bay rum. The problem of helping these people to help themselves is a very serious one

and one of the responsibilities which comes to us with the purchase of the island. St. Thomas has been known as the "Gibralter of America" because of its natural impregnability.

One of the sights of interest is the coaling of ships by the old "hand" or rather "head" method. This is done mostly by women and the coal is carried in baskets on their heads with apparent ease. Since the baskets are porous the dust sifts down over the carriers but fortunately their complexions are not greatly changed. They receive something like two cents a basket for their work. Many depend upon this kind of work for their livelihood.

St. Croix

St. Croix, the largest of the American Virgin Islands, unlike St. Thomas, is fertile and has been known as the "Isle of Sugar and Rum," although the rum stills, we were informed by the governor, have been dismantled since the enactment of the Eighteenth Amendment. Sugar growing is the main enterprise, while rum was produced as a by-product of the former.

The Virgin Islands are under military rule and the governor spends a part of his time in the Island of St. Thomas and a part in St. Croix, although, I believe, St. Thomas is really regarded as the capital city. During our stay in St. Thomas we had the privilege of lunching with the Governor and on leaving for St. Croix a wireless was sent to his secretary there to meet us and turn over the government house to us for our use during our stay in the island. The government house was the old royal mansion of the Danes, which came to us with the purchase of the islands.

Although sugar-growing is the chief industry this is not as profitable as it was in old slavery times. Slavery was introduced into the islands at a very early date, and the most characteristic features of the island are the numerous obsolete stone windmill towers, guard houses, and slave quarters, substantial structures of stone but now often abandoned. There are a number of large sugar plants but steam has replaced the windmill in the grinding of cane.

After a delightful week in this beautiful island, during which time many plants were collected, some entirely new to science, we sailed for Porto Rico by way of St. Thomas, completing our work

there and returning home early in the spring to carry on a scientific study of the collections of fungi consisting of more than one thousand in number.

FRED J. SEAVER.

NARCISSI, OR DAFFODILS[1]

There is much confusion as to just what to call this group of flowers. The well-known amateur, Mr. E. Augustus Bowles, divides the inhabitants of the Globe into two classes, those who ask and those who answer the question, "What is the difference between a daffodil and a Narcissus?" There is really no difference, as Narcissus is the Latin name and daffodil the English. One group, the descendants of *Narcissus Jonquilla,* are the true jonquils and it is incorrect to use this name for other daffodils. Jonquils are distinguished by their rounded, rush-shaped foliage. The name daffodil probably comes from Taffid, the Welsh for David, as it is the national Welsh flower and was recently reinstated as such in the arms of Great Britain. This is the flower a Welshman wears in his cap on St. David's Day (March 1st)—not the leek, as popularly supposed. While there are thousands of varieties of Narcissi known today, but one was known to the ancients, the bunch-flowered Narcissus, *Narcissus Tazetta* or *Narcissus polyanthus.* It was used for funerals and specimens have been discovered in tombs opened in our times. About two hundred years before Christ, two sorts were known, *Narcissus Tazetta* and *Narcissus poeticus.* The Elizabethans knew a number of varieties and grew them in their gardens, for we see them pictured in Gerarde's "Herball" and in Parkinson's "Paradisus." After this there is little mention of daffodils until the middle of the Nineteenth Century, when Messrs. Barr, Herbert, Burbidge, Leeds, etc., etc., enthusiastically took up the genus and began searching for species and hybridizing. At one time daffodils were classified by being divided into three groups, the large-, medium-, and short-cupped or crowned Narcissi, but so many new types have been produced that great confusion has resulted,

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, May 2, 1925.

in consequence of which the Royal Horticultural Society has now arranged them in eleven groups with subdivisions, making sixteen in all, under which heads they are now exhibited at shows. It can readily be seen that it is difficult to judge a flower of one group against one of an entirely different type.

The culture of daffodils is simple, as they require little care. Several points should be remembered, however, the most important being, never to let manure come into contact with the bulb. Bone-meal, preferably " rose bone-meal," is the fertilizer to use, if one is desired. Dig the soil well and plant so that the bulbs are covered once and a half again their own depth from the bottom to where the neck begins. This is a good rule to follow as the different varieties vary greatly in size. After the ground freezes, cover with well-rotted manure or put on a little salt hay. Leaves are not good for covering as they mat together. If you do use leaves, those of the oak or beech are the best. In the spring, remove the covering gradually as the tips of the daffodil leaves are seen to be pushing up. Turn the soil over between the bulbs with a small hand-fork and a few seeds of a shallow-rooting annual plant such as alyssum may be scattered. Divide the Narcissi every five years or so, if they become very much crowded and cease to bloom well, and choose the time just after the leaves have ripened off for digging. Replant just as soon as possible as daffodils deteriorate when kept out of the ground and they must begin to make their root growth early to produce good flowers. Plant your finest, most expensive varieties in the flower-border in groups, not rows, and put the others in the grass to appear as if growing wild. Do not mow the grass until the leaves of the bulbs have ripened off. A plan should be made before the bulbs are put in; they can then be scattered accordingly and planted wherever they lie. Henceforth they need never be disturbed.

The lecture was illustrated with about ninety colored slides of the individual flowers and of gardens both in England and the United States, showing daffodils "naturalized." Among the slides were several, showing the planting of the great collection of about forty-eight thousand Narcissi then blooming at The New York Botanical Garden. The speaker referred to the embargo on Narcissi which goes into effect January 1, 1926, and to

the necessity for adding some varieties to the Garden collection this year. She asked for subscriptions, which may be sent to Dr. N. L. Britton, Director-in-Chief, The New York Botanical Garden, Bronx Park, marked " Narcissus Fund."

ETHEL ANSON S. PECKHAM.

THE DEVELOPMENT AND CULTURE OF THE IRIS*

The Iris well deserves its present popularity on account of its hardiness and adaptability to various garden conditions, as there is no section in which it cannot be successfully grown in America, and it succeeds also in Europe, Asia, Africa, and Australia.

In America Iris may be divided into two chief divisions, the bearded flag Iris of gardens (wrongly called German Iris) which need dry soil and sunny situations, and the beardless or grassy leaved Iris, which flourish in moist and semi-aquatic situations. This latter class contains some of our native American species, as well as the famous Japanese Iris.

The bearded flag Irises have been the most popular in America for the past one hundred years. They are developed from the species native in Europe and Asia Minor, and have been greatly improved by gardeners during the last century in Europe, and during the last decade in America. Many hundreds of varieties were introduced into commerce before 1880, and these were nearly all the result of cross fertilizing by bees. Since 1880, however, many of our finest varieties are the result of careful hand-crossing by plant breeders. Among the most successful of these breeders have been Sir Michael Foster, of England, who died in 1907, and who has been followed there by Mr. A. J. Bliss; the Vilmorins and Ferdinand Denis, of France; Goos & Koenemann, of Germany, and Mr. B. H. Farr, Miss Grace Sturtevant and Mr. W. E. Fryer, and many others in America.

These bearded Irises may be planted any time between April and December in the northern states; they should be given dry and sunny situations, and good soil enriched with lime and bone

* Synopsis of an illustrated lecture given in the Museum Building of The New York Botanical Garden by the President of the American Iris Society on Saturday afternoon, May 23, 1925.

meal instead of animal manures, which are sometimes liable to cause Iris rot, a disease prevalent in some varieties in wet seasons, but which should not assume serious proportions in well-kept gardens. The only other enemy to be considered is the Iris borer, which is also best controlled by sanitary garden measures.

Plants should be divided at least every three years and while this can be done at any time, immediately after flowering is probably the best. By the selection of varieties the various Irises may be had in bloom from April to June, beginning with the Dwarf Bearded Iris such as *pumila, chamaeiris* and hybrids such as Socrates, Citrea, and Schneekuppe. These can in turn be followed by the Intermediate hybrids, such as Fritjof, Ingeborg, and Royal, which should carry the season of bloom down to the end of May in the latitude of New York. With them come the popular Blue Flag of old-fashioned gardens, *Iris germanica,* and with it the white Florentina and the purple Kochii. Then comes the group of late bearded hybrids, of which we have many fine varieties, but of which I will mention here only the following dozen: Pallida Dalmatica, Flavescens, Mme. Chereau, Iris King, Rhein Nixe, Arnols, Her Majesty, Fairy, Quaker Lady, Isoline, Aurea, and Mrs. H. Darwin. This dozen gives a wide color range, but many other varieties, equally good or better, could be chosen.

Following these Bearded Iris come the Beardless or grassy-leaved varieties, among which the Siberica group, such as Orientalis, Snow Queen, and Grandis make splendid garden plants, for moist situations, as do also the Spuria group, including Monspur and Ochroleuca, and for aquatic situations the native *versicolor* and its near relative *Pseudacorus,* the yellow Fleur-de-Lis of France. These bring the Iris season along near the end of June, when the Japanese Iris (varieties of *Iris Kaempferi*) begin to bloom and last for several weeks. These range in color from white through to pink and blue and deep purple, in both three-petal and six-petal forms. At present, unfortunately, through the carelessness of Japanese nurserymen, and the difficulty of reading their labels, these Irises are much mixed up in commerce, so that it is even impossible to suggest a good list of varieties.

Irises have been grown here more than a century, but the tremendous increase in the interest taken in them has led to a separate society, devoted entirely to Iris. This Society has undertaken

the great task of straightening out the confusion in the nomenclature (a task similar to that undertaken by the American Peony Society fifteen years ago). It also issues bulletins and gives flower shows in different sections of the country to encourage flower growing, and it is our hope that it will prove of great benefit to all gardeners.

JOHN C. WISTER.

FLOWERS FOR SPRING GARDENS*

Between forty and fifty varieties of flowers that bloom in the spring can be confined in a space the size of the ordinary back yard, or home garden. And nature seems so profligate with her color in spring that these flowers make a braver show than those of any other season. It is hardly necessary to recommend the spring bulbs. These are being increasingly used and favored, but the rich yellow, sulphur, white, and green tones, so much spring's own, which the daffodils afford, are not sufficiently utilized yet for our small gardens. The daffodil is also self-maintained, and grows luxuriantly in the grass, under the hedge or under the trees. Hyacinths, for deep rich colors; or just tulips alone, early, May-flowering and Darwins, will span the whole season with fragrant and showy bloom. The other spring flowers which are low, compact, and at the same time showy, are golden yellow alyssum, moss pink or *Phlox subulata,* with rose, lilac, and white carpets for ground, rock or wall cover; the rock cress, a gray carpet with fragrant white flowers which attract the early bees; the blue lungwort, evergreen candytuft, and aubrietia, in every shade; and all the iris tribe from the early crested and dwarf types to the last of the bearded iris of late spring.

The flowering shrubs start with the golden bell and the fragrant bush honeysuckle, and are followed by the Japanese quince in three or four colors, the white bridal-wreath or spirea, of various kinds, the double-flowered almonds, plums, and hawthorns, the fragrant mock orange, and the flaming showy azaleas, not to mention the always welcome lilac. These are all adapted

* Abstract of an illustrated lecture given in the Museum of The New York Botanical Garden on Saturday afternoon, April 25, 1925.

for furnishing spring flowers for small gardens. Even the early-flowering trees are often small and compact. The flowering cherries and crabapples are supreme spring flowers for small places. A feature pertaining to all these flowers is their foresightedness or preparedness. They are all ready to bloom before the winter sets in, in buds wrapped or covered securely by nature, protected against the severe weather, but ready to open when the spring sun begins to warm them. So it is wise to uncover and care for the low plants early. It is even necessary to begin to care for the spring flowers during the previous summer and autumn. Iris growers recognize the summer as the time of preparation for next spring's bloom, and do their planting in early summer. Then too we must prune the trees and shrubs soon after blooming time, in the summer, because they immediately start to put out new flowering wood for next year. Should they be cut during the winter season or early spring, it is the flowers of spring that are being cut. Most of our parks today lack color because the shrubbery was trimmed. Witness the sparse flowering of the magnificent Forsythia in most places.

Of course our bulbs are previous autumn work, so that spring flower results in most cases are from fall preparedness.

Flowers from the collections of the garden were shown at the lecture and excursions made to view the display of daffodils, tulips, and hyacinths, then in full bloom.

KENNETH R. BOYNTON.

BOTANIZING IN THE COLOMBIAN ANDES*

The lecture was an account of an expedition made under the auspices of The New York Botanical Garden with the coöperation of Harvard University, the Smithsonian Institution, and the Philadelphia Academy of Natural Sciences as a part of the general botanical exploration of northern South America which is being carried on by these institutions.

The lecturer traced in order the route of the expedition from its entrance into Colombia by the Pacific port, Buenaventura, over

* Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, May 16, 1925.

the western and central ranges of the Andes, and back to the coast. The railroad journey up from the western coast is one of very great interest, with an astonishing variety of picturesque botanical situations and much scenic beauty. Passing up through the dense coastal jungle, one emerges in a cactus and acacia desert which invited repeated visits. At La Cumbre, a summer resort at the summit of the pass over the western Cordillera, at an elevation of 5,250 feet, the well-equipped American hospital, the Smith Clinic, extended its hospitality for important excursions into neighboring subtropical forests. In the great central valley of the River Cauca, one may proceed northward by boat, or by railroad and motorbus, to Zarzal, thence by mule pack-train up through the well-known coffee region of the Quindio to the town of Salento, at an elevation of about 7,000 feet, which was the expedition headquarters for some weeks.

From that town, besides numerous excursions to neighboring valleys for orchids and ferns and other striking plants, one of the most notable, as well as the hardest of trips, was that over the Old Quindio Trail, memorable as the route of the famous Humboldt expedition in 1801, now rarely traveled, where the profusion of passion flowers and fuchsias, orchids and tree ferns, and surpassing all else, the miles of trail through the forest of majestic wax palms, produce an impression never to be forgotten.

From Salento another excursion of greatest interest and joy to the botanist was one made to " Alaska," the high mountain estate of the Tobón family. From a cabin there as a base, expeditions were made up through the fine temperate forest to the high *paramo,* or treeless region at the foot of the Nevado del Quindio, where the camp was surrounded by a great variety of characteristic alpine plants with brilliant-hued flowers usual in similar regions, but dominated by the extraordinary densely-woolly shrubs of the Composite Family, called *Frailejones,* which furnished some of the most notable photographs secured. The hospitality and courtesy of Señor Alfonso Tobón and of other Colombian gentlemen and officials will be long remembered.

The lecture was illustrated by more than eighty lantern slides, many of them colored in accordance with careful employment of standard color charts during the field work.

TRACY E. HAZEN.

A SET OF GARDNER'S PLANTS FROM BRAZIL

There has recently been incorporated into the herbarium of The New York Botanical Garden a set of specimens of flowering plants, about 1,600 in number, collected by George Gardner in Brazil, between 1836 and 1841, and received by us through exchange with the British Museum. Though comparatively small in size, this series of plants is of such unusual historical and scientific value that it well merits a word of discussion.

George Gardner was born in 1812, and in 1836, having completed his education in Great Britain, he set forth on an extended botanical expedition to Brazil, supported by the subscription of twenty-four botanists and botanical institutions who received sets of his collections. His sojourn in Brazil continued for five years, during which time he traveled over almost all of that large country which was then readily accessible, and his collections amounted to about seven thousand numbers. The largest representation of this accumulation is now conserved in the herbaria of the British Museum and the Royal Botanic Garden, while the smaller sets are widely distributed in Europe, and not a few specimens have in one way or another reached America.

While numerous collectors had visited Brazil prior to Gardner, no detailed taxonomic study of the rich flora of the country had yet been made, and the existing literature was widely scattered. Gardner himself immediately began the study of his own collections after his return from Brazil, and in a series of papers in Hooker's London Journal of Botany, from 1842 to 1848, described a large number of new species. Many specimens in our set are of the particular collection numbers referred to by Gardner, and therefore authentic examples of Gardner's species.

In 1840, the first fascicle of the monumental *Flora Brasiliensis* appeared, under the editorship of Martius, and continued till 1906, when the final part was published, bringing the work to over twenty thousand pages with descriptions of almost as many species. In the production of this work, with the exception of some of the earliest parts, the collaborators had the advantage of Gardner's collections, and here again numerous new species were based on his material. Many of these are found in our set, while hundreds of other specimens are referred to by number, permitting us to examine authentic material as a supplement to the description.

The Botanical Garden has been engaged for several years in research on the flora of northern South America, every country of which borders on Brazil, and the activities of Dr. Rusby and his associates, in connection with the flora of Bolivia, largely centering at the Garden, have continued for nearly forty years. The plant life of the Guianas is primarily Brazilian in character, and for those countries as well as all the others in the region under our study, the *Flora Brasiliensis* is in constant use. It can be easily appreciated that this set of Gardner's plants, serving to illustrate the printed book by actual and authentic specimens, will be of the greatest value in the furtherance of our research.

H. A. GLEASON.

NOTES, NEWS, AND COMMENT

Dr. A. B. Stout, of the Garden staff, spent a week during May at the State Experiment Station at Geneva, N. Y., in prosecuting studies on the pollination of fruit crops.

A lecture on "Sterilities in Plants" was given on May 5th by Dr. A. B. Stout before the local chapter of the A. A. A. S. at the Pennsylvania State College.

Professor Robert A. Harper and Dr. Marshall A. Howe represented The New York Botanical Garden at the annual meeting of the National Academy of Sciences held in Washington, D. C., April 27–29.

The American Iris Society has provided for two scholarships for the investigation this spring of sterilities in the Irises. These scholarships have been granted to Miss Louise Cover and Miss Marjorie Swabey, who are carrying on the work at The New York Botanical Garden. A survey is being made of the principal varieties to determine what ones will yield seeds, what ones may be used as pollen parents in crossing, and what are the possibilities and the limitations in breeding from seed.

Among the visitors to the Garden during the spring months were the following botanists: Profs. M. L. Fernald and B. L.

Robinson, Cambridge, Mass.; Mr. Robert S. Sturtevant, Wellesley Farms, Mass.; Mr. and Mrs. A. L. Winton, Wilton, Conn.; Profs. H. M. Fitzpatrick and John P Young, Ithaca, N. Y.; Prof. George H. Shull, Princeton, N. J.; Prof. R. Kent Beattie, Dr. Neil E. Stevens, and Dr. Charles Thom, Washington, D. C.; Prof. J. C. Arthur, Lafayette, Ind.; Prof. George R. Wieland, New Haven, Conn.; Prof. E. M. Gilbert, Madison, Wis.; Prof. N. L. Gardner, Berkeley, Cal.; Prof. G. R. Bisby, Winnipeg, Manitoba; Mr. Carlos E. Chardón, San Juan, P. R., and Prof. J. Henry Burkill, Singapore.

At a joint meeting of the Torrey Botanical Club and the Wild Flower Preservation Society of America, held in the Museum Building of The New York Botanical Garden on Wednesday, May 27th, it was announced that a bill had been passed in the New York State Assembly and Senate at Albany and signed by the Governor, intended to protect the "Trailing Arbutus" (*Epigaea repens*). The bill was introduced by the Hon. T. Channing Moore, of Bronxville, and was referred to the Committee on Conservation. It is hoped that the new law will in some measure help to keep this interesting plant from extermination, and that other plants which suffer quite as much from depredation, such as the dogwood, laurel, magnolia, and holly, may be also protected by law.

Professor C. R. Orton has been granted a year's leave of absence from the Pennsylvania State College to take up investigations on seed-borne parasites for the Boyer Company, Inc., under the direction of the Crop Protection Institute. The work is being carried out at the Boyce Thompson Institute for Plant Research at Yonkers, N. Y., where most adequate facilities are being furnished both in laboratory and field. The studies include organic mercurial compounds as well as standard disinfectants for seeds and their effect upon plant growth.

Among the five busts unveiled at The Hall of Fame, New York University, on the afternoon of May 21, was one of the botanist Asa Gray, by Chester Beach, the gift of The Gray Herbarium and of friends and relatives of Dr. Gray. The formal presenta-

tion was by Miss Katharine P. Loring, niece of Mrs. Gray and the unveiling was by Miss Alice A. Gray, niece of Dr. Gray. Dr. Charles W. Eliot, President Emeritus of Harvard University, made a tribute by phonofilm, and Dr. B. L. Robinson, Asa Gray Professor of Systematic Botany in Harvard, gave an address. Dr. Eliot said, in part:

"The Hall of Fame, in passing down to posterity and name and lineaments of Asa Gray, is commemorating one of the most fortunate and happiest of American students and teachers. He was fortunate in that his career lay within a period when North America was first being thoroughly explored and its botanical treasures brought to light, and in that he was free alike from the restrictions of poverty and from the incumbrances of luxury. . . Finally, Asa Gray enjoyed the satisfaction of having rendered a great and lasting service to his countrymen and to mankind. He knew that he had done much to diffuse among his countrymen a knowledge of botany and a love for it, that he had placed on firm foundations the Botanical Department of Harvard University, and that the collections he had created there would have for future generations great historical and scientific interest. To have rendered such services was solid foundation indeed for heartfelt content. May his effigy here long suggest to future generations what the durable satisfactions of life really are."

The four wreaths with which the bust was decorated included one from The Brooklyn Botanic Garden and one from The New York Botanical Garden. The latter was made chiefly of the leaves of *Shortia galacifolia,* an attractive evergreen perennial, the botanical history of which is intimately associated with the distinguished memory of Asa Gray.

Dr. John K. Small returned to the Garden on May 27th from his botanical reconnaissance in the Gulf States and contiguous territory. He was accompanied by Dr. Edgar T. Wherry, of the Bureau of Chemistry of the United States Department of Agriculture. Fifty consecutive days were devoted to field-work. Transportation was effected by motor-truck. A distance of seven thousand miles (speedometer measurement) was covered. The altitudes ranged from near sea-level to seven thousand feet. The general course of exploration followed—from a start at Cape Sable, Florida (the most southern point on the mainland of the United States)—was up the eastern coast of Florida to Jackson-

ville, thence to Gainesville in the upper part of the Florida peninsula, to Tallahassee, across northern Florida, along the Gulf coast region of Alabama, Mississippi, Louisiana, and Texas to the delta of the Rio Grande (a close second to the latitude of Cape Sable) at Brownsville, which lies approximately one thousand miles across the Gulf of Mexico and west of Cape Sable. From the mouth, or delta, of the Rio Grande, they drove up the Texas side of the river to El Paso. Half way up the river, they left the Coastal Plain, and entered the Great Plains and the Basin and Range regions. El Paso being the western limit of their proposed investigation, they turned eastward and drove up to the "Panhandle" of Texas, thence eastward through central Arkansas to northwestern Louisiana and eastward through middle Mississippi and Alabama to northern Florida and down the western coast region, finishing the excursion at Cape Sable. The principal phytographic areas visited may be referred to in a general way as: The unique coastal region—particularly the scrub, coastal dunes, and kitchenmiddens—of eastern peninsular Florida. The pinelands, hammocks, river-swamps, and prairies of the coast region of northern Florida, Alabama, Mississippi, Louisiana, and Texas. The clay-dunes and other features of the delta of the Rio Grande, the hills of the coastal plain along the Rio Grande, the mountains and cañons of the Edward's Plateau, the mountains and mesas of the Great Plains region along the Rio Grande, the four higher mountain masses of the Trans-Pecos region—the *Guadelupe* on the New Mexico border, the Chisos in the Big Bend of the Rio Grande, and the Davis Mountains and the Waco Mountains, which occupy a middle ground between the two already mentioned. To these might be added Mt. Franklin with its numerous cañons near El Paso. Proceeding eastward from El Paso, there are the deserts and sand-dunes leading to the sloped plains where the numerous rivers rise that drain into the Gulf of Mexico, some of them through the Mississippi River. Then the escarpment of the plains which falls off into the central lowlands and the Wichita Mountains, and other elevated regions. In eastern Oklahoma, the Lowlands pass into the Ozark Plateau, the Boston Mountain, and the Ouachita Mountains, which rugged country also occupies the northwestern half of Arkansas. South of the Arkansas River lies the rolling country

of the upper part of the Coastal Plain, which also characterizes northern Louisiana, Mississippi and middle Alabama, where there are extensive areas of chalk barrens. The finish was made through the flat Coastal Plain of the Florida peninsula, the elevated Lake region, the adjacent prairies and Lake Okeechobee. The reconnaissance was made chiefly for preliminary observations and special collections, looking toward an interpretation of the flora and floristics of the southeastern United States and involving a vast amount of data which it will take several years to organize. Several thousand specimens for study were brought back to The New York Botanical Garden and several hundred photographs of flowers, plants, plant-associations, and scenery augment the collections.

Meteorology for April. The total precipitation for the month was 1.92 inches, including a few flakes of snow on the 20th. The maximum temperatures for each week were 68.5° on the 4th, 68° on the 8th, 79° on the 15th, and *87° on the 23rd.* The minimum temperatures were 36° on the 3rd, *28° on the 6th,* 32° on the 17th and 29° on the 21st.

Meteorology for May. The total precipitation for the month was 3.49 inches. The maximum temperatures recorded for each week were 71.5° on the 9th, 85° on the 17th, *92° on the 23rd* and 83° on the 31st. The minimum temperatures were *38.5° on the 8th and on the 9th,* 42° on the 13th, 41° on the 19th and 41° on the 25th.

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THE NEW YORK BOTANICAL GARDEN
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NOTES, NEWS, AND COMMENT

ACCESSIONS

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THE SCRUB–PALMETTO—SABAL ETONIA

The mature stage of the scrub-palmetto resembles the young stage of the cabbage-tree (*Sabal Palmetto*). This palm was doubtless observed by the early botanical travelers in peninsular Florida, but, on account of its habit of growth, it was not distinguished by them from the young plants of the common cabbage-tree. The mature plants of the scrub-palmetto and the plants of the cabbage-tree before the trunk has developed, are very similar in their vegetative characters. The only prominent characters above the ground to separate the two species are the shorter leaf-stalks, the short prostrate spadices, and the large fruit of the scrub-palmetto.

Two very different geologic formations, the one a firm limestone, the other a very loose sand, harbor the scrub-palmetto. Independently, these habitats yielded it to botanists within a period of a score of years.

These two different geologic formations are covered with quite unlike plant-associations. The limestone, an oölite, forming the Everglade Keys, supports a typically West Indian flora. In its plant-covering, the Caribbean-pine (*Pinus caribaea*) and the saw-palmetto (*Serenoa repens*)—a small green form—are the conspicuous elements, and associated with these is a miscellany of tropical American herbs and shrubs, as well as a series of endemic species.

The sandy habitat of the scrub-palmetto is the so-called "scrub," whence the English name of the palm. The flora of the "scrub" is supported on a fine white sand. Its most promi-

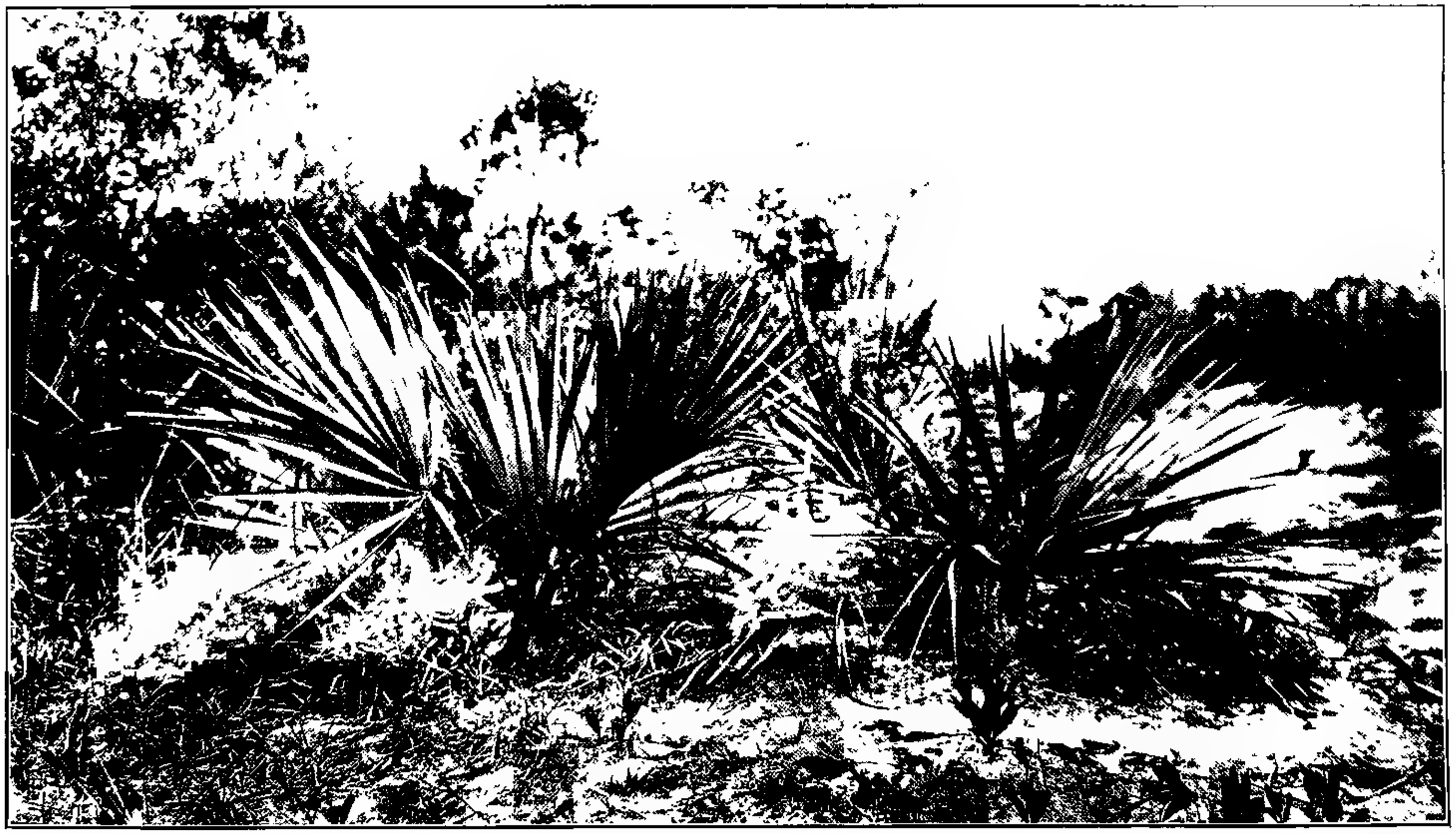

FIGURE 1. In the southern end of the lake region, Florida, where the gigantic mounds or dunes of sand abut on the Indian Prairie. The plant association here is the most distinctive in the state, and endemic herbs, shrubs, and trees abound. The scrub-palmetto is more abundant here than elsewhere, often covering the white sand, acres in extent, alomst to the exclusion of other vegetation. When this photograph was made (May), the plants were in full bloom. The plumes of white flowers may be seen spreading under the leaves.

nent elements are the spruce-pine (*Pinus clausa*), various scrub-oaks (*Quercus* spp.), the saw-palmetto (*Serenoa repens*)—a large white form, the rosemary (*Ceratiola ericoides*), and a curious composite shrub, *Garberia fruticosa.* Associated with these is a series of specialized Floridian plants and endemic trees, shrubs, and herbs.

Whether the scrub-palmetto represents a remnant of a former wider geographic distribution, including Florida, perhaps, as a result of immigration from the West Indies, where, evidently, it is now extinct, or whether it originated in Florida and spread no further, we do not know. If, however, the species is not tending toward extermination through natural conditions and enemies, then the white man is doing his part to exterminate it, not only in the clearing of land generally, but in removing the esculent bud for food, just as is done in the case of the cabbage-tree.

In the seventies of the last century, A. P. Garber,[1] during one of his general collecting trips to Florida, discovered the scrub-palmetto at Miami on the Everglade Keys. The specimens then gathered were among those forming the first extensive representation of the flora of the Everglade Keys, especially about Miami. Among other specimens from these collections they reached A. W. Chapman,[2] who, seeing that they represented something different from any known palm of the United States, described the plant in the second edition of his Flora[3] as *Sabal Palmetto mega-*

[1] Abram Paschall Garber was born 23 February 1838, at Columbia, Pennsylvania. He was graduated from Lafayette College in 1868, and studied medicine at the University of Pennsylvania, receiving his degree in 1872. He went to southern Florida as a health-seeker about 1877, and while there devoted much time to the collection of the plants of that region, whose flora was then little known. In 1880 he also collected plants in Porto Rico. In 1881 he returned to Pennsylvania, and died there, at Renovo, the same year, 26 August.—JOHN HENDLEY BARNHART.

[2] Alvan Wentworth Chapman was born 28 September 1809, at Southampton, Mass. He was graduated from Amherst College, where he attended Amos Eaton's lectures on botany, in 1831, and spent the next few years as a teacher in Georgia, where he studied medicine. He removed to Florida in 1835, and was a physician at Apalachicola from 1847 until his death more than fifty years later. The first edition of his famous "Flora of the Southern United States" was published in 1860. He died at Apalachicola, 6 April 1899, in his ninetieth year.—J. H. B.

[3] Flora of the Southern United States. Ed. 2. 651. 1883.

FIGURE 2. In the northern end of the lake region, Florida, where the hills of snowy sand lie in parallel ridges. The scrub palmetto is less plentiful here than southward. Perhaps, as this region has long been accessible, the use of the "cabbages" for food has depleted the supply. A plant in fruit is shown above. These fruits were doubtless a welcome variation in the diet of the aborigines. In addition to being relatively large, their flavor resembles that of the date—quite in contrast to that of the strong-scented fruits of the saw-palmetto, one of the important foods

carpa. This name refers to the large fruit, which somewhat resembles that of the Texan cabbage-tree. The specific name, *Etonia,* by which the plant now is known, is Indian, and is derived from the habitat, the Etonia Scrub, where Walter T. Swingle studied the plant and its habits in the early nineties of the last century.

This is one of our four endemic palms. The four kinds are all low-growing plants, at least typically so. The three—needle-palm, blue-stem, dwarf-palmetto—other than the scrub-palmetto, moreover, have no immediate relatives. The scrub-palmetto is, so to speak, a cabbage tree much modified in habit. It has two relatives in the United States, the one the common cabbage-tree of rather wide geographic distribution and the other the Texan cabbage-tree of restricted distribution. During the last decade of the last century this palm was observed in the lake region of Florida. The species was thoroughly studied. Subsequent to this study, almost twenty years after it was discovered in southern Florida, it was described and published as a species. Appended to the descriptive matter were the following notes by G. V. Nash:[4]

"It [*Sabal Etonia*] is related to *Sabal Palmetto,* but it is abundantly distinct from that species, particularly in its manner of growth. The rootstocks of the two species are totally unlike. In the seedling state they are probably very similar, judging from examinations made on comparatively young plants of both forms. As they grow older, however, the differences in manner of growth become very marked. In *Sabal Etonia* the rootstock is elongated and more or less contorted, in some instances doubling

[4] George Valentine Nash was born 6 May 1864, in Brooklyn, New York. He early became interested in the flora of New Jersey; about 1888 he made the acquaintance of George Thurber (1821–1890), who influenced him toward specialization in Gramineae, and divided his grass herbarium with him. In 1894 and 1895 he made extensive plant collections in Florida. In 1898 he was appointed general assistant at The New York Botanical Garden, then being established; two years later he became head gardener, a position he retained throughout his life. He made botanical expeditions to Haiti, in 1903; to Inagua, in 1904, and to Turks Islands and Haiti, in 1905. In later years he devoted more time to the study of orchids than to that of grasses. He died in New York City, 15 July 1921. —J. H. B.

and redoubling on itself, forming a perfect *S*. It is firmly anchored in the soil by innumerable roots, borne along its under surface, the growing end running along the surface of the soil, but never rising above it. As stated above, the rootstock is always elongated, from 2–3 feet in length, the rear part apparently dying and rotting away as the bud advances.

" In *Sabal Palmetto* the behavior of the rootstock is very different, and only in the very young plants can its early stages be found. It goes directly down, then bends sharply and rises to the surface, continuing in an erect aërial stem which often attains a height of 50–70 feet. In the young plants this downward portion is manifest as an erect spur-like body, appressed to and much smaller than the ascending part of the rootstock, but it soon disappears and in plants but a few feet in height no trace of it can be found. In old individuals, therefore, the subterranean extremity of the trunk is knob-like, with hundreds of roots radiating in all directions, making a marked contrast to the elongated and contorted rootstock of *Sabal Etonia*, bearing roots its entire length. The fruit in *Sabal Etonia* is larger than that in *Sabal Palmetto*."[5]

The habit of the stem or rootstock of this palm, as described in the preceding paragraph, is, apparently, immutable. It is easy to understand that the characteristic underground movements and postures can be readily accomplished in loose sand, as when the plants grow in the " scrub " of the lake region, but on the rocky floor of the pinewoods of the Everglade Keys conditions are quite different. However, the plant holds true to this peculiar characteristic, even here, apparently without exception. The rock surface of the Everglade Keys was honey combed long ago by erosion, and the cavities, large and small, long since were filled with sand, humus, and fragments of rock. Now, the seedling palm in growing evidently adjusts itself to conditions and finds buried erosion holes or pot-holes of sufficient size to accommodate the mature rootstock, else the individual dies. Never have we noticed a rootstock above the surface.

Although its quarters must often be cramped in the rock floor of the Everglade Keys, the plants in that region are just as robust and prolific as they are in the loose sand of the " scrub."

[5] Bulletin of the Torrey Club **23**: 99, 100. 1896.

The scrub-palmetto is not as ubiquitous as the cabbage-tree, nor nearly as beautiful. Nor, does it grow naturally in such a great variety of habitats. It may have been more plentiful and more wide-spread formerly. Being an esculent plant, the Florida aborigines may have seriously curtailed its abundance, just as the present inhabitants are now doing where the plants grow plentifully. In some places where it was abundant about a quarter of a century ago, plants are now hard to find.

The bud is eaten, as is that of the cabbage-tree, and it is said to be superior to that of the *Sabal Palmetto,* although it is not quite as large. The fruits also are edible, and in both size and flavor are superior to those of the cabbage-tree.

JOHN K. SMALL.

WHAT PEOPLE DRINK AND WHY[1]

For the purposes of this lecture, drinking is defined as the swallowing of a liquid for other than medicinal purposes.

The presentation is neither fanatical nor controversial. In stating why people drink certain beverages, it is their own view that is supposed to furnish their reason, and their reasons are analyzed and evaluated only so far as established facts may justify.

The drinking of such liquid foods as milk and soup is purely a dietetic procedure, aside from its addition to the supply of water in the body, the latter pertaining to the satisfaction of thirst. The dietetic importance of foods in this form is of great, often of vital importance. Such foods are more appetizing than solids, and may appeal in cases of malnutrition when other foods are objectionable. Their greater digestibility is often of importance. The particles of nutrient matter, being finely divided, are more readily reached by the digestive enzymes, their nutritive efficiency being thus increased.

The principal object of drinking is to satisfy the thirst, by which is meant not merely the moistening of the mouth and fauces, but supplying all the tissues of the body with the water

[1] Abstract of an illustrated lecture delivered by the Dean of the College of Pharmacy of Columbia University, at The New York Botanical Garden, June 20, 1925.

that is necessary for maintenance of their work. The moistening of the mouth and fauces contributes great comfort when thirsty, but the thirst itself could be equally assuaged by the injection of water into the blood-vessels. The various ways in which water functions in the vital processes were briefly reviewed. It was specially noted that for the performance of some of these functions, certain substances held in solution in the water are responsible. When the natural body fluid is deficient in such dissolved substances, they must be artifically supplied, this subject involving medical considerations.

Outside of the meeting of these absolute physiological requirements, which involve the use of water only, all objects of drinking may be classed under the heads of protection, comfort, pleasure, and assistance in the performance of work, which subjects are severally considered.

Protection.—Under certain conditions, as long-continued exposure to cold, the superficial blood-vessels may become contracted and the blood be concentrated in the internal organs, resulting in congestion, stasis, and dangerous or fatal disease, such as pneumonia. The introduction of alcohol to the circulation will enlarge these superficial vessels, restoring the circulation to these parts, and averting the dangers referred to, and its use is resorted to for that purpose with great frequency. There are large and often densely populated districts, even entire countries, where the water supply is polluted by disease germs to a dangerous degree and where the people habitually drink wine or malt beverages as a sanitary precaution. Millions of such people never taste water, as a beverage, from one year's end to another.

Comfort may be promoted by the addition of substances to beverages which will reduce the annoyance of a dry mouth and throat. In very dry and hot weather, the moistening effects of water are very quickly lost, and the desire to drink becomes almost continuous. The relief afforded by drinking may then be increased by the addition of mucilaginous substances to the water. In country districts, flax-seed, elm bark, and sassafras are commonly employed to secure this result. Acid substances, such as lemon-juice and tamarind are very grateful. In southern Europe, and in the orient, the mucilaginous seeds of various species of Plantago (plantain) are largely employed. In the arid regions

of the southwestern United States, and in Mexico, the seeds of several species of Salvia are similarly used, under the name of Chia. Northern people, visiting the tropics, are tempted to use great quantities of lemonade and limeade for this purpose and serious and persistent stomach troubles are often produced in this way. A combination of acidity with mucilaginous content is secured among farmers by the very common practice of adding vinegar, molasses, and wheat bran to the drinking water. A very thirst-satisfying beverage, largely used in the tropics, is the liquid contained in young coconuts. A clear, watery liquid, it is very slightly sweet and acidulous, and is cool even when the surrounding temperature is high. There are other plants in tropical regions from which almost pure drinking water can be obtained, as the hollow joints of bamboos, the hollow leaf bases of the traveler's palm, the juicy pulp of cactuses, and the porous stems of various woody vines. Most of these liquids contain small amounts of dissolved substances which increase their power of relieving the sense of thirst in mouth and throat. It is to be noted that many plant juices, as those of oranges and pineapples, contain vitamins that are essential to human health. The subject of vitamins has been greatly abused through ignorance and charlatanry, but the importance of the subject can scarcely be overestimated. The daily administration of a small drink of fresh orange juice to children is very beneficial.

Under the head of comfort, reference may be made to the common country practice of using alcohol to secure warmth in winter, and to promote coolness in summer. Inconsistent as it seems, both customs are based on physiological processes. Our sense of heat resides in the heat-nerve endings of the skin. When a low temperature drives the warm blood from the surface we have the sensation of being cold. When alcohol restores the blood to these vessels, which closely invest the heat-nerve endings, an agreeable feeling of warmth is afforded, although this condition promotes the radiation of heat from the surface, with a reduction of temperature. In the summer, on the other hand, the tendency of the alcohol is to paralyze or depress the heat-nerves so that we do not sense the warmth, and thus appear to be cool. It also increases heat radiation.

This depressing effect of alcohol, which, after all, is its chief and dominating action, may work in many ways to reduce indi-

vidual discomfort. All physical sensation of pain is lessened by the depressing or stupefying effect of alcohol, and it can be so used as to become a complete anaesthetic. Enormous amounts of alcohol have been consumed to secure this result. Anxiety, grief, remorse, fear, and other forms of mental suffering are similarly lessened, and inebriety has been greatly promoted through the habitual dependence of such sufferers on this artificial relief.

Closely allied to this relief of physical and mental discomfort by the depressing effects of alcohol is its negative action in carrying a subject through physical or mental emergencies. An understanding of this subject, like most of what follows, depends on an appreciation of the difference between an action and a resulting effect. The belief is almost universal that alcohol acts as a stimulant, whereas the reverse is true. When, however, its depressing action is exerted on an inhibitory function, the visible effect is naturally one of stimulation. The Spanish fleet, lying in Santiago Harbor, and realizing that it must go forth and encounter the United States fleet, resorted to the use of liberal amounts of alcohol by its officers and men. The depressing action of these libations on the faculties of judgment and prudence overcame the emotion of fear, and imbued the force with what is often called "Dutch courage," and they went forth to a desperate fight, the adverse result of which was the more certain for them because of the incapacitation effected by the same agent that had stupefied their just fear. In other words, the alcohol did not give these men courage, but it did reduce their fear. Between these two actions, there is all the difference of a contradiction.

Unprincipled employers, in the olden days, were accustomed to supply rations of rum to their workmen when an extraordinary occasion called for exceptional activity. Not only the dread of hard work, but the sense of its fatigue were deadened, and the men could be hurrahed into unusual endurance. Undoubtedly, the quality of their work was impaired by the related impairment of their powers, but yet there was an increased output and an apparent stimulation of activity. In the same way literary workers, under stress of emergency, may lose a part of their feeling of fatigue and be led to work on to the verge of exhaustion by the use of this so-called stimulant. Lawyers, actors, public

speakers, even preachers may dull their feelings of timidity, whether justified or uncalled for, in facing their ordeals, and be enabled to win applause when they had been oppressed by a fear of failure. This artificial killing of fear is far less worthy than the firm conquering of oneself by the summoning of his own powers and the development of his just confidence in them. The cumulative effect of the latter process, however difficult, or even painful, is one of healthy development and individual growth. That of the former is very apt to result in deterioration. The world's biographical histories are blackened by thousands of failures and wrecks of brilliant men and women in every walk of life, resulting from this habit.

Of a very similar character is the promotion of social fellowship and jollity by the aid of John Barleycorn. From the mere effacement of excessive reserve, there are all stages to that in which the individual loses all powers of self-restraint and all sense of proper modesty. All this is manifestly a process of depression, though commonly regarded as one of stimulation. To the action here described, the term narcotic has been firmly attached. By it, the intellectual functions are affected unequally and the proper intellectual equilibrium is destroyed. Mental activity is not stimulated, or even induced, but it is permitted by the suppression of restraint, and its character is neither restrained nor regulated by either judgment or will. Quantity is increased, but usually at the expense of quality.

Totally different is the action exerted by another class of beverages, depending for their activity on the presence of caffeine or related alkaloids. These substances are directly stimulating to cerebral activity, and stimulate all its functions. Thus, the mental equilibrium is preserved, and quantity of mental activity is increased without any sacrifice of quality. This effect is in no sense a narcotic one, although tea and coffee are often spoken of as narcotics. Although the habit of tea or coffee drinking to excess may be feared, this habit is not a dominating one, and is not to be classed as a dope addiction, as is that of excessive use of narcotics. Besides tea and coffee, we have in this group Maté, or so-called Paraguay tea, the Cola seed, guarana, dahoon, and chocolate. All these substances increase circulation and elimination, produce a feeling of comfort and cheerfulness, and are justly

said to cheer without inebriating. The use of one or more of them is almost universal. It is not improbable that additions to our present known list may yet be made, as the habits of aboriginal people become better known. Where no beverage of this kind is known, the natives sometimes resort to the chewing of substances containing similar constituents. To this class may be referred the chewing of coca leaves, the alkaloid cocaine acting in some ways like caffeine, although definitely habit-forming, and very dangerous.

In tropical America, one or more seeds in the bean family, as those of *Cassia occidentalis,* are used as a coffee substitute, but their action is quite different. They are true narcotics, and dangerous. The same is true of the leaves of Ledum, or Labrador tea.

The so-called cereal coffees, as postum, are scarcely entitled to any classification here. They are merely flavored water, with a little dissolved nutrient matter, and more properly classed as weak broths.

Reverting again to the consideration of alcoholic beverages, it must not be overlooked that the use of some of them is largely for the effects of constituents other than the contained alcohol. Most important of these substances is perhaps carbonic acid gas. This substance is very efficient in destroying disease germs in the beverage. It is agreeable to the palate, and is more efficient in relieving the source of thirst than plain water. Its presence in our soft summer drinks is about all that can justify the use of many of these digestion-destroying mixtures. Plain carbonated waters are far preferable to most of the over-sweetened and highly flavored slops so extensively used. The use of beer and its relatives is largely for its carbonic gas, and the stomachic and digestive properties of its hops and malt. Its moderate use is probably better justified than that of any other beverage except water.

Of the many alcoholic beverages in use by aborigines the constituents are not so innocent. As is well known, an alcoholic liquid can be prepared from any substance that contains sugar, or any that contains starch, provided the latter is first converted into sugar by the action of an amylolytic enzyme, such as diastase or ptyalin. Some of these vegetable substances contain consti-

tuents that profoundly affect the system. For example, Kava, so largely drunk by the Pacific islanders, contains an anaesthetic, that has a peculiar soothing or numbing effect on the nervous system, and another that is powerfully diuretic. Some of these constituents are extremely powerful narcotics, producing hallucinations and trances similar to those of opium and hashish. To this class belongs the pellota or Mescal buttons used by the natives of northern Mexico and adjacent United States. A very similar one is the Caapi of the Colombian natives, of which so much has been written of late. These substances produce a very profound disturbance of the entire nervous system, and are even capable of causing death if used in great excess.

H. H. Rusby.

HOW TO THINK ABOUT EVOLUTION[1]

The lecturer's thesis was that the most important thing is to know *how* to think about such questions as religion and science and their relation to each other. If one knows how to think, the question of *what* to think is largely settled. The prime requisite is an open mind, ready at any time to receive new evidence and, if necessary, to discard ideas based upon inadequate evidence, no matter how fondly cherished the old ideas may have been. Nothing should be accepted as fact, except upon verifiable evidence.

All science advances by the accumulation of data based on observation, the framing of hypotheses as to the most probable explanation of the observed facts, and the thorough testing of the hypothesis. The lecturer emphasized the difference between a hypothesis and a guess. Guessing has no place in scientific method.

As a result of testing, a hypothesis may either be verified or found inadequate. If the latter, it must be abandoned, just as were the hypotheses concerning the motions of the heavenly bodies or concerning the nature of atoms.

[1] Abstract of a lecture given at The New York Botanical Garden on the afternoon of July 11 by the Director of the Brooklyn Botanic Garden. Dr. Gager is author of "Heredity and Evolution in Plants," and of "The Relation between Evolution and Religion: How to Think about It.,, now in press.

This history of human thought shows the necessity for toleration among those of divergent views, and the futility of personalities and the imputing of unworthy motives to those who honestly differ from us on matters of religion and science.

The present more or less organized attack upon science—particularly upon the principle of evolution—by churchmen has been characterized by the imputing of unworthy motives to scientific investigators and teachers, and has disclosed a gross ignorance of the aims of science, and of the nature of scientific method—particularly the difference between fact and hypothesis.

In particular the lecturer showed that, while there may be irreconcilable conflict between superstition or tradition and modern science, there cannot be any conflict between true religion and science, for there can be no conflict between two truths.

C. STUART GAGER.

JAVA AND THE JAVANESE PEOPLE[1]

The Island of Java, lying just across the equator south of Singapore, is the most crowded country in the world. Thirty-six millions of people are massed together in a space no larger than the state of New York, and a great part of the area is too mountainous to be inhabited. The lower lands appear to the traveler to be almost one continuous village. Rice, tea, rubber, sugar, and coconuts are the chief productions, and Java yields through these industries a handsome profit to the Dutch, who own the island and control its commerce.

When the Dutch took possession of Java, at the close of the Napoleonic wars, they found it populated by a much smaller number of people, divided into numerous tribes continually at war with each other. The rapid growth of population in a century speaks well for the colonial policy of the Dutch government. During the same time the country has been completely civilized, and hundreds of miles of railways and roads opened throughout the island.

Visitors to Java find it necessary to learn the Malay language in order to make their wants known to the natives. This is not

[1] Abstract of an illustrated lecture given at The New York Botanical Garden, June 13, 1925.

difficult, since the language is remarkably simple, having neither conjugations nor declensions. Usually the tourist learns all the Malay he needs in less than a week.

Regular lines of passenger and freight steamers connect Java with Europe, Asia, and North America. The chief passenger port is Batavia, near the western end of the island and its largest city, but much freight is handled from Soerabaya, located in the great sugar-growing region of eastern Java.

The chief attraction to tourists is the world-famous botanical garden at Buitenzorg, where a marvelous collection of over sixteen thousand varieties of tropical plants may be seen in cultivation. Here are the largest existing collections of orchids and palms, while the famous avenue of canary trees, their trunks covered with tropical vines and their crowns meeting in a Gothic arch over the driveway, is the delight of every visitor. Their displays of fig trees, of tropical oaks, of dipterocarps, and of bamboos are equally interesting, though less striking to the average tourist. All of these are grown without the protection of greenhouses, since the temperature rarely falls below seventy degrees. Vegetation of all kinds is here unusually luxuriant, since rain falls every day and amounts to 180 inches per year. Laboratories have been provided for visiting botanists, and here some of the most important research on the life of tropical plants has been carried on.

Within sight of Buitenzorg are three volcanoes, two of them rising to heights of over twelve thousand feet. On one of them is a large reservation of tropical forest and an annex to the botanical garden, with excellent collections of conifers, tree-ferns, and grass trees.

H. A. Gleason.

TULIPS[1]

The spectacle offered here a year ago by nearly the whole of a collection of 80,000 tulips of 166 varieties being in bloom at once and again today by the blooming of more than half that number has served to direct special attention to this magnificent

[1] Abstract of an illustrated lecture given at The New York Botanical Garden, May 9, 1925.

flower. Not that the tulip is a rare flower, for it is an acquaintance of everyone who pays the least attention to flowers. And it is not a new flower, for from all accounts of Europeans who have loved and developed it, it had been raised by the Turks in the sixteenth century, and it was then that the enthusiasm over the tulip started. By 1613 there were many kinds in cultivation. Besler described nearly 50 varieties from the Archbishop John Conrad's garden on Mt. St. Wilibald, in Eistadt, Germany. The plates illustrating those flowers show a flower about like our early single tulips of today. Then the Dutch found that they were able to raise tulips in quantity with succeess and in the early 17th century were so enamored with the beauty of the flower that the rulers of Holland had to legislate against speculation in tulip bulbs.

For several reasons tulips should be our favorite spring flowers. In the first place, they give us masses, veritable carpets of rich colors, of unequaled diversity. Then an almost certain result may be obtained for a comparatively small expenditure and thirdly they are grown very easily and last a number of seasons (attained by using the several types of tulips).

For success use in planting a well-drained, deeply dug soil, with well-rotted manure previously added or bonemeal directly added. Plant in the autumn, according to the old rule of "when the leaves fall," placing the early varieties four to five inches apart and as deep, and the late varieties five to six inches apart and as deep. About 200 to 250 tulips will fill a bed twelve feet long and four feet wide. After the ground freezes, cover the bed with a mulch of salt hay or straw or leaves. This mulch is removed in March and the flowers may be expected in late April and all of the month of May.

The varieties of tulips are so numerous that each must pick his own variety. In general, tulips are rich red, yellow, white, pink, purple, and violet, in the early spring types; yellow, rose, russet, lavender, pink, white, and the more delicate shades of red, in the Cottage or May-flowering types; bronze, tinged purple, red, and yellow, in the Breeder types; and maroon, chocolate, mahogany, rose, pink, and red, in the globular, long-stemmed sorts in the late Darwin types. These types and varieties may be grown under all conditions.

Besides the varieties shown on the slides, with which this lecture was abundantly illustrated, a study of the varieties then in bloom was made after the lecture.

KENNETH R. BOYNTON.

THE CHARLES PATRICK DALY AND MARIA LYDIG DALY FUND

The will of ex-Chief-Justice Charles Patrick Daly, probated October 23, 1899, provides:

"Article 8, Section 3. I give, devise and bequeath to my executor, Henry R. Hoyt, the sum of twenty thousand dollars, in trust, nevertheless, to invest and reinvest the same, and to pay over the net annual interest, dividends or income thereof to my wife's sister, Rosalie Staples, semi-annually for and during the term of her natural life, and upon her death to pay over the said principal sum to The New York Botanical Garden."

Subsequent to the death of Mr. Hoyt, this bequest was transferred to The New York Botanical Garden, in trust, and annual interest has been paid over to Mrs. Staples semi-annually. The death of Mrs. Staples, early in 1925, has brought the principal sum into the ownership of the Garden; at the meeting of the Board of Managers held June 18th, 1925, it was designated, The Charles Patrick Daly and Maria Lydig Daly Fund, as a memorial of Judge Daly and Mrs. Daly, highly esteemed and valued advisors and benefactors of the Garden in its early years. The income of this fund, about $1,000 annually, will be available for any of the corporate purposes of the Garden.

N. L. BRITTON,
Secretary.

PUBLIC LECTURES DURING JULY AND AUGUST

The following is the program of the lectures given on Saturday afternoons at four o'clock in the Museum Building of The New York Botanical Garden during July and August:

July 4. "Trinidad: Its Flora and Scenery."

Dr. F. J. Seaver.

July 11. "How To Think About Evolution."
Dr. C. Stuart Gager.
July 18. "Seeds: Their Tricks and Traits."
Dr. William Crocker.
July 25. "Lilies." Dr. A. B. Stout.
Aug. 1. "The Forest Resources of the Northwest and Their Conservation." Prof. George B. Rigg.
Aug. 8. "Flowers of the Summer Garden."
Mr. Kenneth R. Boynton.
Aug. 15. "The Rose Mallows, Cultivated and Wild."
Dr. A. B. Stout
Aug. 22. "The Dismal Swamp of Virginia."
Dr. Arthur Hollick.
Aug. 29. "Scenery of Our Western Mountains."
Mr. Le Roy Jeffers.

NOTES, NEWS, AND COMMENT

Mr. Otto Degener, who has been spending the year at The New York Botanical Garden, studying his collections of Hawaiian plants, is returning to Honolulu. He began his transcontinental journey in June by motor-car, planning to make botanical collections on the way.

Dr. A. B. Stout, of the Garden staff, spent a week in June at the State Experiment Station at Geneva, N. Y., in further work in the breeding of grapes for seedlessness. Observations were also made on the results of the tenting experiments with various fruit trees conducted earlier in the season.

Dr. P. A. Rydberg, Curator of the Museums and Herbarium of The New York Botanical Garden, is devoting a large part of June and July to field work in the Allegheny Mountains. He is traveling by automobile and is accompanied by Mr. John T. Perry, of the Massachusetts Agricultural College.

At a meeting of the Linnean Society of London held on May 7, Dr. Nathaniel Lord Britton, Director-in-Chief of The New York Botanical Garden; Professor Carl Schroeter, of Zürich; and

Dr. Alexander Zahlbruckner, Director of the Department of Botany of Natural History Museum in Vienna, were elected Foreign Members.

During the early part of June, The New York Botanical Garden, represented by Dr. F. J. Seaver, joined with Cornell University, Department of Plant Pathology, and the Pennsylvania State College, Department of Botany, in a mycological excursion to Trout Run, Pennsylvania. This is the third "foray" of this nature held by the above institutions.

The Garden has issued invitations to its members and friends to make special inspections of its various floral exhibits on designated days when such displays were anticipated to be at their best, so far as this might be determined or conjectured a week or two in advance. Thus, for the present season, April 24 was Narcissus Day, June 9 was Peony Day, and June 16 was Rose Day. The tulips were so nearly in their prime on the day of the Annual Spring Inspection, which occurred on April 30, that no special Tulip Day was observed.

The July number of *The National Geographic Magazine* contains a contribution by Miss Mary E. Eaton, artist of the staff of The New York Botanical Garden, under the title "Pages from the Floral Life of America." The editor's introduction is as follows:

"The 24 color plates, representing 55 flower paintings, appearing in this number of *The National Geographic Magazine*, are from the brush of Miss Mary E. Eaton, whose work has brought so much pleasure to members of the National Geographic Society during the past decade. They are reproduced from the Society's 'The Book of Wild Flowers,' recently published, and are printed in the *Magazine* in order that those who have saved their back numbers may have a complete collection of Miss Eaton's published paintings. The flowers represented in this number belong to 49 different families, and, together with those previously published, make a representative cross-section of the floral life of America."

On many of the western yellow pine forests in the Northwest, the pine squirrel and the second-growth pine may be said to be engaged in a struggle to the death, with the squirrel holding a

conspicuous advantage according to latest reports, says the Forest Service, United States Department of Agriculture. The squirrel's advantage is due to the fact that, somewhat like the early bird, he is busily collecting the seed before it has a chance to "dig itself in" and develop into a pine seedling. In examining some 15-year-old cuttings in Montana, the Priest River Forest Experiment Station found that practically no new growth has come in. Cones are plentiful in the two or three seed trees an acre left for seeding new growth and show sufficient seed to start up at least an open stand in 15 or 20 years against all other enemies of young trees; but there is evidence that the pine squirrel is determining otherwise, and that possibly nothing short of planting such areas with seedlings will circumvent the sharp eyes and insatiable appetite of this small foe.

Meteorology for June. The total precipitation for the month was 2.98 inches. The maximum temperatures recorded for each week were *101.5° on the 5th,* 92.5° on the 10th, 93° on the 18th, and 85.5° on the 22nd. The minimum temperatures were 64° on the 3rd, 51° on the 12th, *50° on the 17th,* and 53.5° on the 24th.

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OF

THE NEW YORK BOTANICAL GARDEN

NEW DAY LILIES

A. B. STOUT

SEEDS: THEIR TRICKS AND TRAITS

WILLIAM CROCKER

A FREAK OF THE MOUNTAIN LAUREL

ELIZABETH G. BRITTON

NOTES, NEWS, AND COMMENT

ACCESSIONS

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JOURNAL
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NEW DAY LILIES

Numerous new varieties of day lilies (*Hemerocallis*) have recently been developed at The New York Botanical Garden through hybridization. These plants extend considerably the range in the color, size, and shape of the flowers for this group of ornamentals and include a goodly number of hybrids whose flowers are pleasing and attractive. The results already realized indicate that the rather simple flower colors of the older species may be broken up, recombined, and even intensified through hybridization, thus producing an increased diversity and yielding new forms of special interest and value to the flower-grower.

The list of day lilies available for general garden culture and for breeding purposes is not a long one. There are, however, about ten recognized species in cultivation to begin with. Of these the lemon day lily (*Hemerocallis flava*) with its fragrant and clear yellow flowers and the still more common orange day lily (*H. fulva*) are best known. The record of their culture in Europe extends back nearly 500 years. Possibly they were brought to Europe from Asia as early as the time of Marco Polo. In recent years other species have been brought from the Old World to the New.

Of them all, *Hemerocallis fulva* has the gayest flowers. In this the throat of a flower is deep chrome, outside of which there is a zone of English red extending with decreasing intensity to the tip of the six flower segments. The pattern is fairly well indicated in Figure 2 (the middle flower of the upper row). The flower is bi-colored with the chrome and the red in conspicuous contrast.

For the flowers of the rather recently introduced species *H. aurantiaca* there is a rich orange throat, outside of which there is a delicate blending of orange and red with the red much more subdued and delicate than in the *H. fulva.*

For each of the other species the flower color is of an almost uniform shade of some grade of either yellow or orange.

It is to be stated that few persons have thus far contributed in any noteworthy extent to the horticultural improvement of the day lilies. Mr. George Yeld, of England, deserves special mention for the production of some dozen named hybrids involving the species *Hemerocallis flava, H. aurantiaca, H. Dumortierii, H. Thunbergii,* and *H. minor.* In Italy Mr. Carl Sprenger and his nephew, Mr. Willy Müller, obtained seed of *Hemerocallis* from China and grew seedlings which were related to but different from the old cultivated form of *fulva.* One of these, designated as *H. fulva* var. *maculata,* was successfully crossed with *H. citrina* by Müller but these seedlings were apparently lost during the recent war. Several of their hybrids between *H. aurantiaca* and *H. citrina,* obtained at an earlier date, were distributed to the trade in Europe. In a letter which the writer recently received from Mr. Müller it is stated that a head gardener at the Botanical Garden of the University in Strasbourg succeeded, about the year 1911, in obtaining a few hybrids by crossing the lemon day lily (*H. flava*) with pollen of *H. fulva.* This has been verified in a later letter received from Dr. Killian, of the Université de Strasbourg. It appears certain that the form of *fulva* involved in this cross is the one in common cultivation. If so, it is the first record of this cross having been accomplished during all the years that these two have been grown in Europe and America! It is possible to make this cross, for it has been done in the breeding work at The New York Botanical Garden and at present there is a total of 524 plants which have *H. fulva* as one parent or grandparent. The firm of Lemoine, well-known nurserymen and hybridizers in France, is credited with the production of two and possibly three hybrids, Luther Burbank is credited with two others, and several *H. citrina* hybrids have come from Mr. Bertrand H. Farr. Several other hybrids have appeared in the trade, mostly of origin unknown.

FIGURE 1. A glimpse of a few of the hybrid day lilies in the experimental plots at The New York Botanical Garden. The plants here shown are quite typical of many of the hybrids between the variety *luteola* and the species *H. aurantiaca*; they grow vigorously and give an abundance of bloom, which stands in the upper reaches of the foliage or slightly above. Most of the plants selected for propagation as new clonal varieties have this habit of growth, combined with flowers of attractive shapes and colors.

Thus a total of about 75, certainly not more than 100, hybrids in *Hemerocallis* have been reported to date. About 40 have been given varietal names but only about a dozen are to be had in the trade. The number available in the American trade is still less. When compared with such groups of plants as the dahlias, the roses, and the irises the flowers of the available day lilies taken collectively are lacking in diversity of color and form. Their improvement along these lines has been the chief aim of the breeding work undertaken at The New York Botanical Garden.

The first step in preparation for this breeding was to assemble all the known species and varieties obtainable. Persistent efforts have been made to secure the hybrids already produced as noted above but only 14 of these have been obtained at this date. Continued efforts are being made to obtain a more complete collection and also to obtain living plants growing wild in the interior of China in the hope that forms and perhaps species hitherto unknown to Europe and America may be had. Without doubt types of day lilies of interest and value to horticulture are yet to be discovered in Asia. During the past year plants have been obtained from China and from Japan which are different from any of the older species. These are being propagated and utilized in the breeding work.

The main task in the breeding work itself is to obtain seed and to grow seedlings particularly from crosses between different species and varieties but from self-pollination as well. When this is attempted it soon becomes evident why so few seedlings have previously been secured and why with the probable exception of the Strasbourg hybrids the "blood" of *H. fulva* has never been blended with any of the other species previous to the results reported in this paper.

The day lilies as a group possess a decided unfruitfulness or sterility. It is difficult and for some varieties even impossible to obtain seed to self-pollination. The majority of seedlings are fully self incompatible. Crossing between species and varieties and even between seedlings of the same immediate parentage is greatly restricted. For example, the widely cultivated strain of the common orange day lily (*H. fulva*) has, it appears, never been known to yield fruit and seeds to any kind of pollination, self or cross, until four capsules (out of several thousand pollinations)

were secured at The New York Botanical Garden. Neither has its pollen previously been used with success in any crosses unless this was done at Strasbourg.

And so the work of breeding day lilies resolved itself, first of all, into a study of the sterilities, or we may say, of the physiological incompatibilities (both self and cross) in the processes of fertilization. It has been a case of trying to circumvent or overcome the obstinate sterilities characteristic of these plants and most particularly of the gaily-colored *H. fulva.*

This work has been in progress for ten years. Thousands of controlled pollinations have been made. Crosses which did not succeed were repeated over and over until as in the *H. flava* and *H. fulva* cross a few seedlings were obtained. A cross that failed when made directly was sometimes made indirectly, so to speak, by using a third type as an intermediate parent. As a result the gayer and somewhat bold colors of the orange day lily have been both subdued and intensified in combination with shades of yellow, golden-yellow, and orange. This has also been done with the red tint of *Hemerocallis aurantiaca.* A color pattern rather closely resembling that of the commonly cultivated form of *H. fulva* has actually appeared in the flowers of certain hybrids between species other than *H. fulva.*

But certain crosses between species and varieties are easy to make. Thus the yellow-flowered *Hemerocallis flava* and the *H. Thunbergii* with lemon-yellow flowers readily hybridize with *H. aurantiaca.* The variety *luteola* (itself a hybrid between *H. aurantiaca* var. *major* and *H. Thunbergii*) readily hybridizes with *H. aurantiaca* and the seedlings of this cross are among the finest thus far obtained at The New York Botanical Garden. Of the combinations just mentioned more than two hundred hybrids have already bloomed. Hybrids between other species and varieties are also blooming. A total of about 1,500 hybrids (all different seedlings) are being grown.

The flowers of these hybrids taken collectively exhibit a wide range of colors from light lemon-yellow (even lighter than the old *Thunbergii*) to a very dark rich orange. Nearly all these shades are to be seen both in clear uniform color and in combination with various degrees of the red seen in *H. fulva* and *H. aurantiaca.* The red may be rather uniformly dispersed over the

FIGURE 2. The conspicuously large flower in this group is from one of the finest of the new day lilies developed at The New York Botanical Garden. It has the largest full flower known for any *Hemerocallis* and the color is most pleasing. This hybrid has *H. aurantiaca major, H. Thunbergii, H. aurantiaca,* and *H. flava* for its four grandparents!

At the left of this large flower is a flower of *H. aurantiaca,* directly above is a flower of the well-known form of *H. fulva,* and at the right is a flower of the lemon-colored *H. Thunbergii.*

Above, at the extreme right, is a flower of the variety *luteola* which is a hybrid between *H. Thunbergii* and *H. aurantiaca major.* The flower is larger than that of the *Thunbergii* parent, is a light shade of golden yellow but is without the reddish tinges of the *aurantiaca* parent.

At the upper left is shown a flower of the variety Florham, supposed to be of American origin. It has flowers of golden yellow in a shade slightly different from *luteola.*

outer half or two thirds of the petals, quite as in *aurantiaca,* or it may be in streaks, in bands or halos, or in blotches. Different grades of the red may be in the outer three or in the inner three flower segments or the red may be confined to the inner or to the outer three. But thus far no distinct and abundant spotting of red has appeared, such as is seen in various of the true lilies.

The flowers of some of the hybrids have a smooth surface, waxy in appearance; others have a velvety appearance due to minute

finger-like elevations of the cells of the surface. The flowers of numerous hybrids glisten brilliantly in sunlight as if the surface were liberally sprinkled with minute grains of gold, a characteristic that is observed also in the species *H. aurantiaca.*

The best of the flowers are "full," with broad overlapping petals that are improvements on many of the older types. Thus the clear yellow shade of color seen in *H. Thunbergii* is obtained in certain hybrids in flowers that are fuller, larger, and more attractive. Increase in the size of flowers is to be had: some hybrids have flowers nearly twice the size of any of the species or of any of the older varieties thus far seen by the writer and in a few cases (see especially the larger flower shown in Figures 2 and 3) the size is combined with rare beauty and fullness of flower.

Considerable range is seen in general stature and vigor of growth of the hybrids and in the height to which flower stems stand with reference to the tips of the leaves. Some plants, particularly when derived from dwarf parents, are quite dwarf. The most showy and floriferous plants are those that stand with flower stems about three feet tall and only slightly overtopping the leaves, quite as shown in Figure 1. Seedlings with taller and more upright flower stalks are common but are less effective because the flowers are elevated above the leaves with a foot or more of bare stems exposed in a somewhat awkward and ungainly effect. This is one of the defects of the old *fulva.*

The season of bloom for the hybrids corresponds in some degree to that of the respective parents. As a rule hybrids with early-blooming parents, such as *Hemerocallis Dumortierii* and *flava,* are earlier in their blooming than are hybrids with *Thunbergii* and *aurantiaca.* Some of the hybrids have bloomed late in the season so it may be that varieties can be developed which extend the season of the day lilies. At The New York Botanical Garden the best of the seedlings give a succession of bloom with the climax in July just following the season of the irises.

In the improvement of the day lilies, getting a single plant with suitable habit of growth and with flowers of a new and desirable type is the important thing. It is then very readily and rapidly propagated vegetatively by division as a "clonal" variety quite as irises and dahlias are propagated. In such a case the entire

FIGURE 3. (See opposite page for explanation.)

variety is, in reality, one plant whose parts have been separated and grown in different localities. Thus the standard of the variety is assured for the method of its propagation does not involve the variation that is sure to come when there is the seed propagation of hybrids.

It will readily be understood how an entire clonal variety may be self-fruitless. When the original seedling plant happens to be self-incompatible and unable to set fruit and seeds to its own pollen all the plants obtained by dividing its roots and stems are necessarily self-sterile and also pollinations between them are no more effective than are pollinations from flower to flower on any one of the plants as grown. And so many of the clonal varieties

FIGURE 3. Here is shown (on opposite page) the range in the size of the flowers in the various hybrid day lilies recently produced at The New York Botanical Garden. Some suggestion of the coloring is given by the shading. All are rather "full" flowers and are among the best of the seedlings selected for propagation.

A rather small flower of the darkest shade of red yet seen in any day lily is shown at the upper left. The flower standing uppermost has a most delicate coloring and is to some persons the first choice of all the seedlings. Below it and to the right is a flower with colors somewhat as in *H. aurantiaca* and just below this is a full flower with waxy sheen and a clear light yellow. At the extreme left is a somewhat trumpet-shaped flower of good size and of a pleasing orange color, tinged with a faint halo of red. In the center is the same large flower shown in Figure 2.

Seven different species and varieties were involved in the parentage and grandparents of this group of hybrids.

of the day lilies are self-fruitless throughout, as were the original seedlings. Certain varieties are, however, more or less self-fruitful. In *Hemerocallis* cross-incompatibilities between seedlings of the same species, or between members of a set of hybrids are also very general and so the clonal varieties developed from them are cross-sterile. Hence failures to set seed to many pollinations both self and cross are very frequent and persistent in the day lilies which one may grow.

All the species of *Hemerocallis* in the trade are propagated vegetatively. There are therefore clonal strains in all the so-called species in cultivation. The old familiar *fulva* has been propagated exclusively as a clonal variety for at least 500 years. Apparently all the plants of it now growing or ever grown in Europe and America are merely parts of one plant! Some study will be

needed to determine to what extent the day lilies described as species are really good species or are merely clonal strains.

Day lilies have a place in the flower garden. There is scarcely a group of flowering ornamentals that can be grown so easily in the temperate regions and is so free from insect pests and fungous diseases. Although a single flower usually lasts but one day there is a succession of flowers day after day and large well-developed plants, such as shown in Figure 1, will produce a large number of flowers during many days of bloom. The attractive grass-like foliage comes early in the season and remains fresh and green until autumn. The day lilies are especially effective in mixed border plantings to which they will contribute a mass of rich coloring in their due season.

Possibly the progress thus far made in the improvement of the day lilies is, after all, a mere beginning. Now that crosses involving *Hemerocallis fulva* have been accomplished, perhaps further hybridization will more readily follow. Many new colors or color patterns are possible—such as pure white and blotched or spotted types of flowers. At any rate the breeding of these day lilies at The New York Botanical Garden will be continued and extended and attention will be given to the production of new double-flowered types. The most desirable of the new forms will be propagated as clonal varieties, named, and in due time distributed.

A. B. Stout.

SEEDS: THEIR TRICKS AND TRAITS[1]

The fairy tale of the germination of three thousand year old wheat from the tombs of the Egyptian Pharaohs was exploded some years ago. Authentic records show that wheat under usual conditions of storage does not retain its vitality over twenty years. Many records on the other hand show very much greater longevity than this for various other seeds. Not the least interesting of these records is one just published by Ohga, a Japanese botanist. He has excavated from the Pulantien Plain of South Manchuria

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, July 18, 1925, by the Director of the Boyce Thompson Institute for Plant Research.

viable seeds of *Nelumbo nucifera,* East Indian Lotus, that he believes have lain in the moist peat at least 120 years and more likely between 200 and 400 years.

It is interesting to see what has happened to the Pulantien Plain since the Nelumbo plants grew there and deposited their seeds. The seeds are found near the top of a deposit of peat that is now 13 to 20 inches thick. The plants must have grown there when the plain was a shallow receding lake. Since then 20 to 30 inches of fine silt soil have been deposited over the peat, undoubtedly blown by the wind from the adjacent Gobi desert. The Pulantien River has cut such a deep channel through the old lake bed that the bed of this river is now about forty feet below the peat deposit that contains the seeds. Trees that do not ordinarily grow in water are now growing on the silt deposit over the peat where the lake once existed. Some of these are 120 to 130 years old. Mr. U. Liu, the director of the Liantung Bank in Darien, states that his ancestors moved into and cultivated this basin about 200 years ago. Tombs in the cemetery at the village of Liu-Chiatung confirm this statement. All of this evidence leaves little doubt that Ohga is right in placing the age of these seeds as greater than 120 years and more likely 200 to 400 years.

But why have these seeds not germinated before this? Some one may suggest that they did not get sufficient oxygen, buried as they were in the peat two or three feet below the surface of the soil. No, there is another and better reason! Besides it is probable that these seeds can germinate in absence of external oxygen as can the water plantain and many other seeds of water plants. The real answer is that these seeds have not yet lain in the moist earth long enough to absorb water! If the coats are filed (or eaten away sufficiently with concentrated sulfuric acid and then washed) they swell. Every one of these seeds treated in this way to date has germinated and Ohga has some very fine plants as a result. The seeds are not only alive but they are all alive and vigorous.

The seeds of Nelumbo are technically termed "hard seeds," that is, an outer layer of the coats prevents the absorption of water so that the seeds may lie in water or moist soil for years with only now and then one swelling and with many remaining hard for years, and perhaps centuries.

Hard seeds are common amongst clovers, alfalfas, beans, peas, indigo plants, locusts, and many other members of the bean family as well as in the mallow family, the water-lily family and several other families of plants. This character causes much annoyance and considerable economic loss in the first-named family of very important food and forage plants. If one were to gather ripe seeds of red clover and hull them in the palm of his hand, he would find 85 to 90 per cent. of them incapable of absorbing water even after weeks of soaking. Fortunately when the red clover is passed through the huller the coats are cracked, as indicated by the fact that a larger percentage of them swell although the cracks in the main are not visible either to the naked eye or under the microscope.

I gathered sweet clover seeds last fall and threshed them by hand. Up to March 1st only 2 per cent. had swollen after lying in water for months. Because of the greater hardness and less adequate treatment in the threshing process, sweet clover causes greater economic annoyance than red clover.

There is much evidence that a crop of "hard seeds" shed into the soil will lie there for years with now and then a few swelling and germinating. One crop of seeds may thus seed the soil down for fifty years or perhaps in some cases for one or more centuries.

Are hard seeds the only ones that lie in the soil for long periods dormant and capable of germination? By no means! Many seeds that absorb water readily do the same thing.

The cocklebur is an example. If one splits a bur lengthwise through the two horns he will see that it bears two seeds—one a little higher in the bur than the other. The lower seed in the bur germinates the first year after ripening while the upper frequently germinates the second year or later. The delay in the upper seed is due to a very thin membrane that surrounds the embryo and reduces the oxygen supply to it below that needed for germination. The upper seed germinates only when the coat is broken by freezing—becomes ineffective through decay or when the temperature is high enough (91° F.) to overcome the effect of the coat. When the upper seed germinates, depends upon when it meets one of these contingencies. Some other seeds that absorb water readily, lie dormant in the soil because enclosing membranes reduce the oxygen supply to the embryos.

Seeds of the water plantain lie dormant in water for years because the seed contents do not swell with enough force to break the rather delicate but strong coats. These seeds cannot germinate, much as a chicken cannot hatch if it is unable to break the shell. The chicken soon dies under such circumstances but the embryo of the water plantain rests easy for years, if necessary, until some change, slow or sudden, internal or external, brings about the necessary breaking of the coats. Some other seeds remain dormant, due to the same mechanism as the water plantain.

Dormancy in rose seeds is a very interesting story but time and space will not permit its telling in detail. Rose hybridizers stratify these seeds in a cold place. Under this condition the seeds gradually germinate through a period of five to seven years—a long time to wait for the last seedling of the hybrids. Fortunately, science has stepped in here and helped. First, it has shown that the embryos themselves are dormant and that these embryos must go through some very definite and important chemical changes, called after-ripening, before they are ready to grow. Second, science has shown that these changes occur most rapidly when the germinator or stratification bed is held at 41° F. Under this condition the seeds of all the rose species tested to date will after-ripen and germinate within 140 days. Some of the hybrids offer much greater difficulty. It has also been shown that when the stratification bed rises considerably in temperature the seeds go back into the dormant condition. Thus in the old stratification practice much that is gained in the winter is lost the following summer. This old method was a good one but it lacked one very essential feature—that of controlled temperature in the stratification bed. The new method saves time.

Many seeds are like the rose in having dormant embryos and in requiring a low temperature period in a germinator for after-ripening. This is true of basswood, Juniper, fall-seeding maples, haws, peaches, apples and many other seeds. The nature of the soil is sometimes very important. Cotoneaster seeds after-ripen readily in acid peat at 41° F., but not in sand at the same temperature.

The last few paragraphs give some of the mechanisms by which seeds are able to distribute their germination over a long space of

time so that some will always be ready to germinate and seed down the earth. Of what advantage is this to wild plants? Did you ever get your garden so well hoed that no more weeds came up in it? It is possible that that could not be done in one generation even if no weeds were allowed to ripen in the garden and no weed seeds were carried in from outside. Many seeds show time distribution in their germination. This gives weeds and other wild plants great persistence. A great number of seeds per plant and time distribution in the germinations are cardinal features in the survival of species.

The farmers of the South Downs of England find that when they plow meadows that have been growing for twenty, thirty, or forty years, black mustard comes up in profusion, although this weed was not present in the meadows. These farmers believe that the seeds lie in the soil dormant but viable during the entire life of the meadow. Numerous other observations of an entirely new type of vegetation appearing upon soil freshly turned up by the digging of wells, ditches, the removal of buildings, and the plowing of old meadows and pastures have been cited as proving that seeds may lie in the soil quiescent and viable for 25, or even 50 years, and germinate when the soil is loosened up and the seeds given proper air, water, and perhaps light conditions, for germination.

Fortunately these claims, like all claims that are not based on absolutely conclusive evidence, have their "Doubting Thomases." The Thomases say that birds carried the black mustard seeds to the meadows or that a few of the black mustard plants grew on the meadows unobserved and kept them seeded. They even suggest that squirrels buried the Nelumbo seeds that Ohga digs from the Pulantien basin.

The great abundance of the seeds is against the contentions of the doubters in each case, also, the fact that no Nelumbo plants are now growing near the Pulantien basin is against their claims. If neither of these were true the doubters must still acknowledge that it would take the birds and squirrels several years to do all this seeding, so the seeds must lie dormant in the soil for several years at least.

The fatal evidence against the claims of the doubters comes from another direction.

In 1879, or forty-six years ago, Doctor Beal, of Michigan Agricultural College, buried twenty lots of seeds, each including 50 seeds of twenty different species of plants, mainly weeds. These were placed in moist sand in pint bottles. The uncorked bottles were buried on the campus, twenty inches below the surface of the soil, with the nozzle of the bottle pointing downward to prevent filling with water while the sand in the bottle would remain moist. Each five years one bottle has been taken up and the seeds tested for germination. The 40th year test gave the following results:

	Percentage germinated after being buried 40 years.
Amaranthus retroflexus—pigweed	2 per cent.
Ambrosia elatior—ragweed	4 " "
Brassica nigra black mustard	18 " "
Bromus secalinus—brome grass	0 " "
Bursa Bursa-pastoris—shepherd's purse	0 " "
Erechtites hieracifolia	0 " "
Euphorbia maculata	0 " "
Lepidium virginicum –pepper grass	2 " "
Lychnis Githago	0 " "
Anthemis Cotula—dog fennel	0 " "
Malva rotundifolia—dwarf mallow	0 " "
Oenothera biennis—evening primrose	38 " "
Plantago major—plantain	10 " "
Polygonum Hydropiper—smartweed	0 " "
Portulaca oleracea—purslain	2 " "
Rumex crispus—yellow dock	18 " "
Chaetochloa lutescens	0 " "
Alsine media	0 " "
Trifolium repens—white clover	0 " "
Amaranthus graecizans—tumble weed	66 " "
(*Chenopodium album*)—lamb's quarter	*2 " "

*Germinated though not recorded as buried.

From this table it is seen that ten of the twenty-two species of seeds that were buried still retain their vitality after forty years in the moist soil. Two others, *Verbascum Thapsus* and *Bursa Bursa-pastoris,* showed viable seeds at the 35-year test. On the basis of all the seeds buried, 8.2 per cent. of them are still alive but have failed to germinate after forty years in the moist soil. The remaining 12 samples will be taken up at ten-year instead of

five-year periods, thus giving 120 years more for the experiment to run.

Over 20 years ago the United States Department of Agriculture started even much more extensive experiments with buried seeds. They buried seeds of 105 different species in great numbers and in a variety of conditions. Their 20-year tests confirm Doctor Beal's conclusions so far as seeds of wild plants are concerned. Seeds of various grains and some other cultivated plants did not remain alive even five years. Evidently they were not dormant enough to resist germination so they germinated and the deeply buried seedlings perished. Yet the seeds of many cultivated plants are still persisting after being buried 20 years. This is true of timothy, Kentucky blue grass, celery, tobacco, and red clover. It is probable that many more were capable of germination than either Beal's results or those of the Department of Agriculture shows, for neither treated the seeds to overcome dormancy, a thing Ohga found necessary.

Doctor Ewart, an authority on the longevity of seeds, states that seeds will remain alive longer in the soil than in dry storage. This he means to apply only to "hard seeds." The same is true, however, of some seeds that absorb water readily.

A number of years ago I tested more than a dozen different collections of dry-stored twenty-three-year-old pigweed seeds (*Amaranthus retroflexus*) and not one was alive. Yet according to Doctor Beal's experiments these seeds are still alive after forty years in the moist soil. It is still an unexplained mystery how imbibed seeds can lie in the soil so long without entirely exhausting their stored foods by respiration!

Why do dormant seeds germinate so abundantly when an old meadow is plowed or the soil otherwise opened up? Are the seeds continually germinating at this rate and the seedlings being killed by competing vegetation and deep burial or does stirring the soil arouse the dormant seeds? If one takes the seeds of pigweed that have been in the germinator dormant for weeks and gives them a thorough rubbing in the palm of the hand he will find a large percentage of them germinating soon afterwards. Many other cases can be cited of slight agitation arousing resting seeds. There is no doubt that cultivation or loosening up the soil has a similar effect in arousing some seeds from dormancy.

It would be interesting to consider in detail the annoyance and economic loss caused by the rest period in seeds and to see what practical men and scientists are doing to overcome these. Space, however, will permit of only two or three examples. We have already referred to rose seeds and to clovers and various other legumes in this connection. It might also be stated that rather generally when a man wants to cultivate a wild form, whether for decorative or other purposes, he meets an annoying delay in the germination of the seeds. This was true when Germany introduced wild legumes for forage in the eighties and it is true today when nurserymen and florists try to introduce some of the wonderful wild forms for decorative purposes.

Up to the last two or three decades it has been assumed that the seeds of the cereal grains have no rest period. They may have largely lost such a rest period by a process of selection, for if any are delayed long in germination they will not become a part of the harvest. The six months rest period in wild oats in contrast to the very transient rest period in cultivated oats is perhaps evidence for this. We have lately discovered, however, that the rest period in the cereals is sometimes of considerable economic significance.

In the more northern of the winter wheat states the time between threshing and sowing the next year's crop is only a few weeks. The laws require that the wheat must be tested for vitality and purity and officially declared to by the State Seed Analyst before it can be put on the market for seeds. This means that the test must be made very soon after threshing. Now it happens that wheat has a rest period of a few weeks and that this dormancy is lost in dry storage. The State Seed Analyst declared the seed poor on the basis of his tests made immediately after threshing and yet the seed grew perfectly a few weeks later when it was sown. This caused much trouble between the state authorities and the traders in seed wheat. This led to a thorough-going research and fortunately very simple methods were found for germinating the dormant wheat seeds. One is to run the germinators at about 59° F. instead of 68° F. as previously done. Another way is to run the germinators at about 40° F. for a few days and then at 68° F. The latter method is spoken of as "chilling."

The rest period in seeds of the cereals is deeper and longer when they ripen during wet cold weather. In Germany they term barley ripening under such conditions "rain barley." The dormancy in the rain barley delayed malting unduly and various methods of treatment were worked out for shortening the rest period.

Corn that ripens during a dry fall will germinate immediately. It will even germinate on the cob if supplied moisture. Corn that ripens during wet weather has a persistent delay in germination, sometimes extending into the following seeding time. It has been found that drying the corn thoroughly just after harvest, overcomes this delay and improves the keeping quality otherwise. The artificial drying of seed corn in the autumn is becoming a general and a very paying practice in the Canadian Corn Belt. It can no doubt be adopted with great profit in the northern part of our corn belt most years and in all of the corn belt in wet ripening seasons. With our two or three billion dollar corn crop a small improvement in seed means an enormous increase in value!

Some seeds have no rest period but must grow immediately after falling or they die. This is true of the soft silver maple and other spring-seeding maples, and of cottonwoods, willows, and others. For the soft silver maple seeds it has been shown that the short life is due to drying. When these seeds fall from the tree they contain about 65 per cent. of water. When the water is reduced to 33 per cent. or less they are killed. To persist in nature they must fall where they germinate very soon and develop a root system to keep up the water supply. These seeds will retain full vitality for a year, and probably much longer, if kept moist and cold, so they neither dry nor germinate.

Many tropical seeds are short lived and offer great difficulties in shipment in the living condition. If the loss of life in these is due to drying, this difficulty could be overcome by shipping in moist cold storage.

Why do some plants produce seeds that must germinate immediately? It is impossible to answer this question completely but the following facts about maple seeds may throw some light on it. In contrast to the spring-produced maple seeds, the autumn-produced maple seeds have dormant embryos, will withstand drying and require after-ripening in a germinator at low temperatures

preparatory to germination. The fall-produced maple seeds have a winter immediately ahead of them. For safety they must rest until spring. The spring-produced maple seeds have a full growing season ahead of them. They can safely begin growth immediately and produce plants of sufficient size to withstand the winter.

WILLIAM CROCKER.

A FREAK OF THE MOUNTAIN LAUREL[1]

Dr. George E. Stone, of Amherst, Mass., has sent us some specimens of an interesting form of the Mountain Laurel (*Kalmia latifolia*) with deeply divided, almost polypetalous, corollas, from Sunderland, Mass., near the top of Mt. Toby. It was not until this season that we have been able to obtain any flowers of this rare form, and these are from a new station recently discovered. It was originally described from specimens collected in 1870 at South Deerfield in this same region, and sent to Dr. Asa Gray, whose account of it is quoted below. Professor Stone says that "the specimens sent are not so finely divided as regards the corolla, neither is the pink or magenta coloration so intense as in flowers previously seen" by him. The slender divisions of the corolla give the plant a strange appearance, suggesting the flowers of the fringe tree, and the fragrance also seems to be much more marked than in the normal flowers of the laurel. An illustration by Faxon has been printed in Garden and Forest, but without any enlargement of the individual flowers, seeming to indicate that they are all uniform and regular, whereas in these recent specimens great irregularity has been found. The divisions of the corolla are more than half its depth and extend downward from the sinus—between the lobes—and vary in width, the margins being inrolled. The conspicuous knobs or pouches in which the anthers are normally imbedded are absent or represented only by slight excrescences and the anthers are free, either erect or occasionally recurved and in two series of five each—one series longer than the other. Sometimes there are less than 10, or they

[1] *Kalmia latifolia polypetala* Nicholson. Handlist Arb. Kew **2**: 49. 1894. *K. latifolia monstruosa* Mouillef.
Bailey, L. H. Stand. Cyc. Hort. **3**: 1734. *f. 2031.* 1915.

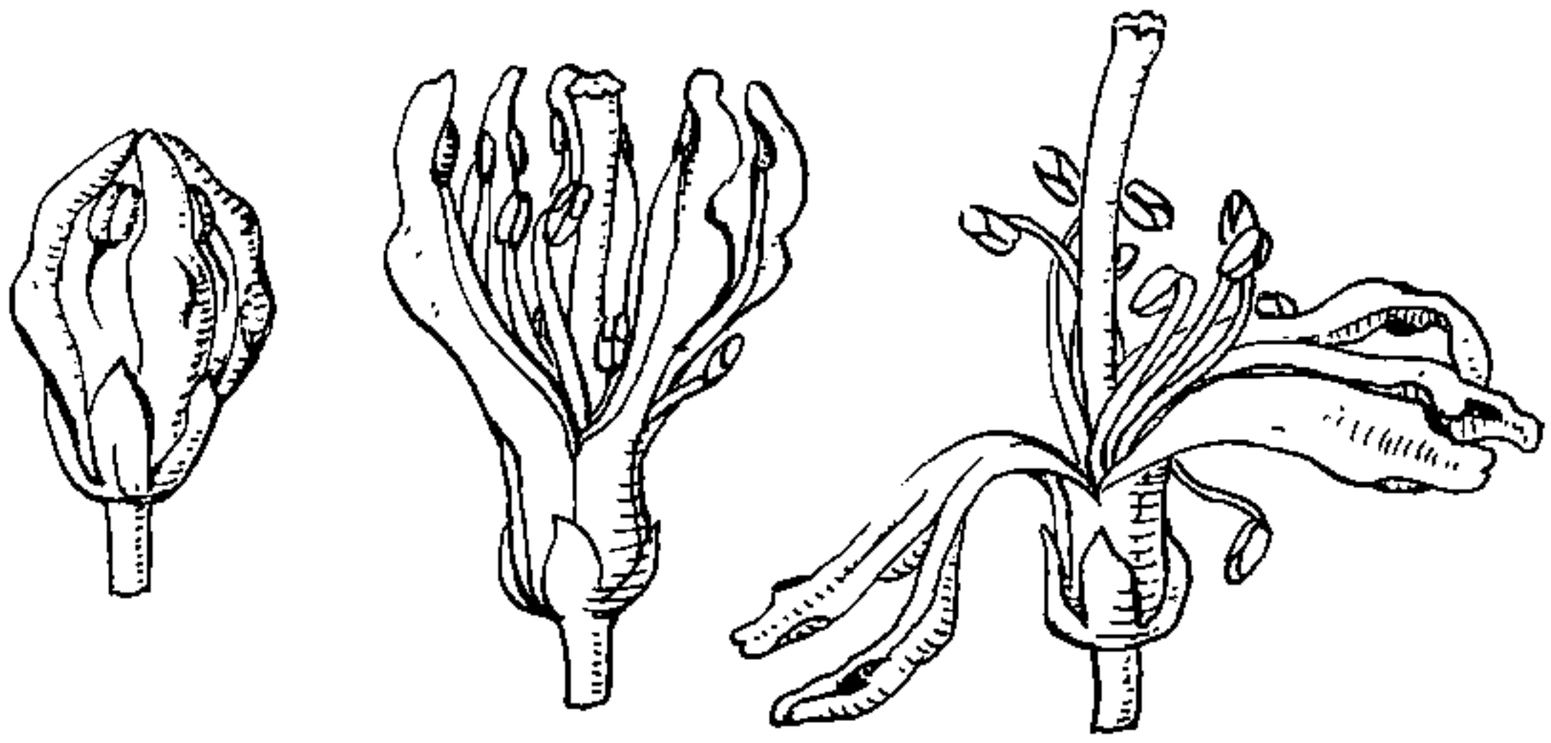

FIGURE 1. Flowers of *Kalmia latifolia polypetala* from Sunderland, Mass., somewhat enlarged.

may be shorter than usual, forming a cluster around the base of the corolla. But the most remarkable development is the one noted by Dr. Gray, clearly indicated by Miss Eaton in the sketch of the flowers now published. These are the dark-red or brown pouches on each side of the divisions of the corolla just below the apex, which resemble anther-sacs but do not appear to be perfect or to contain any pollen. They lie on either side of the projection in which the normal long set of anthers is usually held and are of the same dark red color. The glandular hairs along the dorsal ridges are present, and the calyx also is densely glandular.

This freak is said to set fruit—as is indicated in our specimens—but as far as the records show, no attempt has been made to grow it from seed. One plant has been grown in the Arnold Arboretum, but no further details of importance have been recorded since the descriptions given by Gray in 1870 and by Sargent in 1880. Below are the descriptions of this curious form by Doctors Gray and Sargent:

"DIALYSIS WITH STAMINODY IN *Kalmia latifolia*.—These two technical words we take from Dr. Masters' interesting volume published last year by the Ray Society, entitled 'Vegetable Teratology,' which last word denotes the science of monstrosities. *Dialysis* is the term applied to the separation of parts which are normally united; *staminody* is the conversion of other organs into stamens.

"We have before us a novel and specially interesting monstrosity which is described by these terms. It was discovered by Miss Bryant, at South Deerfield in this state, and we are indebted

to her, through a common friend, for the specimens before us. Among the shrubs of *Kalmia latifolia* which abound in a swamp belonging to Col. Bryant, a few have been noticed as producing, year after year, blossoms in singular contrast to the ordinary ones of this most ornamental shrub, and which, indeed, are more curious than beautiful. The corolla, instead of the saucer-shaped and barely 5-lobed cup, is divided completely into five narrowly linear or even thread-shaped petals. These are flat at the base, and scarcely if at all broader than the lobes of the calyx with which they alternate, but above by the revolution of the margins they become almost thread-shaped, and so resemble filaments. This resemblance to stamens goes further; for most of them are actually tipped with an imperfect anther; that is, the corolla is separated into its five component petals, and these transformed into stamens. Altered as they are in shape, yet a trace of the pouch is often discernible, in the form of a little boss on the outer or lower side, and a slight corresponding depression on the upper. The anther is extrorse and adnate, usually subapical rather than strictly terminal, and its two cells incline to open lengthwise. The ten proper stamens are just as in the normal flower, except that they are erect or at length recurved, and the anthers wholly free, there being no pouches to receive them. The pistil is wholly normal, and there is nothing apparent to prevent the ovules from being fertilized and maturing seed."—A. GRAY, Am. Nat. **4**: 373. Au 1870.

A CURIOUS FORM OF KALMIA

"The monstrous form of Laurel (*Kalmia latifolia*), figured on page 453 of this issue, was disclosed a few years ago by Miss M. Bryant in a large natural Laurel-thicket near Deerfield in Massachusetts. The attention of the public was called to it by Dr. Asa Gray, to whom Miss Bryant submitted specimens, and who published in *The American Naturalist* (iv, 373) an account of this freak of nature in a note entitled 'Dialysis with Staminody in Kalmia Latifolia.'

"The monstrosity consists in the division of the ordinarily five-lobed, saucer-shaped corolla into five narrowly linear or sometimes nearly thread-shaped petals alternate with the calyx-lobes. They are ovate at the base and by the revolution of the margins become sometimes almost thread-shaped above and so resemble filaments, the resemblance being increased by the fact that these petals are occasionally tipped by a single abortive anther. The plant, therefore serves as a capital illustration of one form of dialysis and possesses considerable interest to morphologists. The pouches on the inner surface of the corolla peculiar to Kalmia, which receive the anthers before the flower-

bud expands and hold them back until freed by insects visiting the flower, thus insuring cross-fertilization, are rudimentary in this abnormal variety and are represented by a slight depression on the inner surface and a corresponding boss on the outer surface of the petals. The stamens are normal except that they are erect or at length somewhat recurved with anthers entirely free. The pistil is normal and the plants produce seed freely in cultivation.

"One of the two or three plants discovered by Miss Bryant was introduced into the Arnold Arboretum, where it flowers regularly every year and produced the specimen from which Mr. Faxon has made the drawing which re-appears in our illustration.

"The casual observer seeing the plant in flower would never guess that it was a Kalmia. The flower certainly is not as beautiful as that of the normal Kalmia, one of the most beautiful of all flowering plants. They are very attractive, however, both before and after expansion. This plant, which flowers very freely, is well worth cultivation, therefore, not only as a curiosity, but as an ornament to the garden. It can be propagated by grafting on the normal form of the Kalmia."—C. S. SARGENT, Gard. & Forest **3**: 452. *f. 56.* 1880.

Dr. Stone writes that during the past eighteen years he has found three plants or clumps of this peculiar form at three different stations, all on or near Mt. Toby, which is not far from South Deerfield, the reputed original locality. It would be of interest to know whether its range is restricted to that immediate region and whether it breeds true from seed.

ELIZABETH G. BRITTON.

NOTES, NEWS, AND COMMENT

Dr. N. L. Britton has been recently elected a Fellow of the American Academy of Arts and Sciences.

Mr. Edwin E. Honey, of Cornell University, spent a few days in July in the Garden herbarium, looking over specimens of parasitic fungi.

Mr. Rafael Toro, assistant plant pathologist of the Insular Agricultural Experiment Station, at Rio Piedras, Porto Rico, who has been spending the past school year at Cornell University,

was a summer student at the Garden, where he was engaged in a study of the fungi of Porto Rico.

Professor L. O. Overholts, of the Pennsylvania State College, devoted a considerable part of his summer to a critical study of the specimens of fleshy fungi of Porto Rico and the Virgin Islands in the herbarium of The New York Botanical Garden. He will contribute an account of these groups to the botany of these islands, now being published.

Dr. Arthur Hollick returned July 1, after a three months' leave of absence, during which time he was in Washington, D. C., working on a monograph on the Tertiary flora of Alaska in connection with the U. S. Geological Survey. A previous monograph, on the Cretaceous flora of the territory, was completed by Dr. Hollick last year and transmitted for publication.

The dahlia border of The New York Botanical Garden includes this year 835 plants of 370 varieties. Among the new contributors of roots or green plants are the E. T. Bedford Estate, Green's Farms, Conn.; John Harding, Norwalk, Conn.; T. J. Murphy, Peabody, Mass.; Andrew Lufkin, Gloucester, Mass.; William Seltsam, Bridgeport, Conn.; Wm. Marshall, Staatsburg, N. Y.; L. N. Davis, Stoneham, Mass.; W. W. Kennedy & Sons, Red Bank, N. J.; and F. H. Hall, Geneva, N. Y. Mr. J. J. Broomall, of Eagle Rock, California, has sent a collection of fourteen unnamed seedlings, not yet on the market, and W. H. Waite, Fisher & Masson, Dahliadel Nurseries, Wm. Jost, Meachen & Sherman, Miss Emily Slocombe, Babylon Dahlia Gardens, F. P. Quinby, Richard Vincent, Jr., & Sons, Alfred E. Doty, R. C. Colt, Mrs. Charles H. Stout, Geo. W. Fraser, New Jersey Agricultural Experiment Stations, J. A. Kemp, W. L. W. Darnell, F. R. Waite, Jr., and the Flushing Dahlia Gardens have made their usual generous contributions. The collection includes most of the new varieties that won special prizes or attracted particular attention in the New York and Boston dahlia shows of last autumn.

ACCESSIONS

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

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The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

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THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

VOL. XXVI SEPTEMBER, 1925 No. 309

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OF

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ACCESSIONS

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THE BICKNELL HERBARIUM

The Local Flora Herbarium of The New York Botanical Garden embraces dried specimens representing the plants growing naturally within the circumference of a circle 200 miles in diameter with the center at New York City.

The permanent collection as now constituted was derived mainly from four sources, viz. (1) the herbarium of the Torrey Botanical Club, formally transferred to the Garden by the Club several years ago, (2) the local flora collection made by members of the Garden staff since the organization of the Garden, (3) a selection from the general herbarium of the Garden of the specimens from within local flora area, and (4) an accumulation of miscellaneous specimens that have come to hand from various sources during the several past decades.

During this year a fifth element, the first private herbarium of local flora plants, came into the possession of the Garden, namely, the herbarium of Eugene Pintard Bicknell. It was given to the Garden by Mrs. Bicknell, after Mr. Bicknell's death last winter. In presenting the collection she said, "I feel that it was always his [Mr. Bicknell's] intention to give his herbarium to the Botanical Garden upon completion of its classification and in furtherance of this plan I am very glad to carry out his wishes in this matter."

The Bicknell herbarium is large, but its great value lies in the fact that the specimens were collected and studied by one of the most discriminating observers. The value of large local collections is becoming better known as they have become available. In studying critical groups it is possible to get a real understanding of them and the value of different characters only by having

available large and representative collections from numerous localities. Only by the use of such collections is it possible to understand the range of variation within a species and what are specific and what are merely individual characteristics. A careful study of any such collection in any group also almost invariably brings to light additional points theretofore overlooked which make the understanding of such a group more thorough.

The incorporation of the Bicknell herbarium into the local flora collection will be a long step towards the establishment of a useful basis for the study and interpretation of the local vegetation when some one with the interest and ability appears on the scene to undertake the work in a serious and intelligent manner.

We are now appreciating more and more that each and every plant has a life history of its own. Each plant is doing its own work. We speak, for example, of some plants as growing only in limestone soils and of others as growing only in acid soils. But any such statement must also necessarily mean that the chemical and physical make-up of the plant in question is such that it can break up and use the chemical elements peculiar either to limestone or to acid soils. We must study our plants and find out as far as possible why they require different soils and different surroundings, what are the limitations of each and what work they are performing in the marvelous realm of nature.

The local flora area is large and the topography is varied. As a result the vegetation is varied and species numerous. Consequently, additions like the Bicknell herbarium are very valuable, for withal the Local Flora Herbarium as now constituted is but a scant representation of the vegetation of the area involved and the student in the future who would know and interpret the flora of this local region will need vastly more herbarium specimens, as well as years of consecutive field study. The vicinity of New York probably offers one of the very best fields in the world for such a study. Limestone districts and acid-soil districts, glaciated regions and non-glaciated regions, coastal saline tracts, ponds, pine-barrens, marshes, swamps, rivers, and high hills all abound. Careful and extensive collections, with full field data from all these regions, are going to cast more and more light on the problem of plant uses and of plant distribution, and of the underlying reasons.

The Bicknell herbarium will be of material help in connection with the laudable effort of the present custodian of the Local Herbarium to get a specimen to represent a species from each county of that part of the several States included in the area concerned. The specimens of the various collections such as the Bicknell and those made prior to it are becoming increasingly important, for they, to a great extent, represent the plants of areas whose vegetation has been in the process of being exterminated through the advance of urban and suburban civilization.

The Garden is very fortunate in possessing the collections made in the epoch just past, for these specimens, representing areas no longer inhabited by plants, will be very important to study in connection with those that will be brought together from some of the more remote regions of the local flora area about whose flora and floristics there is yet much to be learned through exploration and study.

JOHN K. SMALL.

THIRD GRANT FROM INCOME OF THE CHARLES BUDD ROBINSON MEMORIAL FUND

Dr. C. B. Robinson was killed by fanatics in 1913, on the Dutch East Indian island Amboina, while prosecuting botanical exploration and investigation there on behalf of the Bureau of Science of the Philippine Islands.[1]

The above-named fund, now amounting to $755, yielding an income of about $30 annually, was established in 1914 by subscription of his friends and has since been held by the Garden, its income specified for aiding botanical exploration and collecting.

The first grant, $50, was made in 1918, to Mr. E. D. Merrill, at that time Chief Botanist of the Bureau of Science of the Philippine Islands, to aid the botanical exploration of the island of Guam, made by Mr. Peter Nelson, of the Guam Agricultural Experiment Station.[2]

The second grant, $75, was made in 1922, to Rev. Dr. Herbert M. Denslow, Honorary Custodian of the Local Herbarium, to aid him in collecting specimens in southern New York.[3]

[1]Jour. N. Y. Bot. Gard. **15:** 106. 1914
[2]Jour. N. Y. Bot. Gard. **19:** 47, 48. 1918.
[3]Jour. N. Y. Bot. Gard **23:** 100. 1922

Under appropriation by the Board of Managers, a third grant of $100 has now been made to Mrs. Agnes Chase, Assistant in the Division of Agrostology, United States Department of Agriculture, to aid her in the investigation and collecting of the grasses of Brazil. Mrs. Chase recently accomplished the exploration of Brazil for this purpose and sends the following account of her work:

N. L. BRITTON.

COLLECTING GRASSES IN BRAZIL

With the financial assistance of the United States Department of Agriculture, The New York Botanical Garden, the Gray Herbarium, The Missouri Botanical Garden, and the Field Museum of Natural History, I was able last year to realize a long-cherished dream of a botanical trip to Brazil. That country is larger than the United States, excluding Alaska, hence a very small part of it could be worked in a single season. I was especially desirous of visiting the parts of Minas Gereas traversed by Martius in 1818, and by the few botanists that visited the interior in the early part of the last century. Many species of grasses of Nees and of Trinius were based on material collected on those journeys. Very little, at least of grasses, has been collected in that region since. Besides Minas Geraes I wished to visit Pernambuco and Bahia.

I landed in Rio de Janeiro November 1 last and left three days later for Pernambuco in order to reach that region before the dry season was much advanced. The strip of sandy coast to north and south and the red clay hills and swamps inland from the city afforded good botanizing.

I made a 4-day trip to Bello Jardim in the sertão, as the arid region of the interior is called. The country is hilly (625 meters altitude) and covered with low scrub. The shrubs, now at the beginning of the dry season, were mostly leafless, but many were in bloom. The country is so closely grazed by donkeys, sheep, and goats that I found grasses only in the shelter of thorny shrubs or of cactus.

Garanhuns, the end of the railroad to the southwest of Pernambuco, is also in the sertão, but afforded much better botanizing. From here, together with two women missionaries, I

went to Paulo Affonso Falls in Rio São Francisco. I had been told that no botanist had visited the falls and I looked forward to a fine harvest, but the great muddy river flows through a desert. The spray from the mighty falls does not water the walls of the gorge, which are hot bare rock. There were plenty of cacti and some beautiful flowering shrubs and vines but very few grasses.

Returning to Garanhuns I went to Macieó, thence by steamer to Bahia.

The peninsula of Bahia is hilly and forested. The trail borders and banks were rich in grasses. I went to Joazeiro, two days journey by rail. Martius crossed Rio São Francisco at this place and collected many grasses there. Donkeys, horses, cattle, sheep and goats have changed the character of the country from what it was in Martius' day. Two places north of Bahia seen from the train, Alagoinhas and Parafuso, looked promising. I spent a day in each and obtained fine collections at both. Another profitable trip was across the bay to Cachoeira and Feira Santa Anna.

I reached Rio de Janeiro the second time early in January, and at once began on classic Corcovado. The grass flora is very rich in the mountains about Rio. Through the kindness of Dr. Campos Porto of the Jardim Botanico, Dona Maria Bandeira, who is working at the Jardim Botanico on the mosses of Brazil, and I had the opportunity to visit Itatiaia and climb its peak, Agulhas Negras, the highest point in Brazil. Above the timber line grasses were abundant. The cuts along the trail below also yielded a fine harvest.

Early in February, toward the end of the rainy season, I went to Minas Geraes. Here I got into the "campos," open or brushy grasslands covering the high hills. I visited Juiz de Fóra, Barbacena, Lavras, Oliveira, Bello Horizonte, Lagoa Santa and Serra do Cipó, Ouro Preto, and Itacolumí, in the *campo* country and Viçosa, Serra da Gramma and Serra do Caparaó in the *zona da matta,* or wooded country. The campo country was exceedingly rich in grasses. Many supposedly rare species I found to be common.

I took with me a compiled list of grasses known from Brazil. There are some 1100 species in this list. I found about 500 species, some being hitherto unknown from Brazil and some, I think,

undescribed. When six months in one small corner of Brazil yields so large a number, it makes one eager to cover more of the country.

AGNES CHASE.

WORK IN THE IRIS TEST GARDEN

The work on the replanting of the American Iris Society's Test Garden for bearded irises at The New York Botanical Garden is just about completed. The centre group of beds numbering from one to twelve inclusive, has been rearranged to color. Instead of a hit or miss medley of twelve hundred varieties, good, bad and indifferent, these beds now contain two hundred and sixty-one varieties, twenty-five being dwarfs, twenty-three intermediates and the others, tall bearded irises. None of these varities "rate" below 7 according to American Iris Socity standards of excellence, so the quality of the plantation is greatly improved. An effort has been made to put in a number of plants of each variety; in many cases, large blocks, so that their true value as garden subjects may be shown, and while the new color classification of the American Iris Society has been very generally adhered to, portions of the planting which would have appeared dull or insipid have been enlivened by the addition of colors that should properly be in another group. Thus, in the white and *plicata* beds dull, dark blends have been introduced and into the dark blends, pale blues and yellows, pink into the light end of the blue bed, and pale blue into the mauve and pink end of the red-purple bed. Some fine kinds have been omitted owing to a shortage of plants, but may be added when these can be procured. Beds 12A, 12B, and 12C of dwarfs, and 5 of intermediates were planted last summer and corrections made this year. These beds are small compared with those dealt with this year and in addition to the color-planting five large beds of bearded irises have been cleaned out and replanted. These beds are situated below the walk and are now being used as a reserve for varieties still under observation. Where there are plants enough available, three of each variety have been retained. Varieties on the Official Black List have been "scrapped" and may now be found only in the Alphabetical Test Garden for indentification and reference. The Alphabetical Test Garden has been checked over, corrected and the gaps

fairly well filled in. The surplus plants of good varieties of bearded irises have been labelled and distributed to other test and show gardens at Cornell, Brooklyn, St. Louis, Rhode Island, Storrs (Connecticut), Springfield (Massachusetts), New Brunswick (New Jersey), Yale University, Larchmont, Mt. Vernon and New Rochelle, N. Y. A truck-load of more ordinary varieties was sent to Central Park and another to Staten Island. The labelling and distributing of this surplus has been no small item and has consumed much time. All beardless irises are now in their own section of the garden and not mixed among bearded ones as before. Four new beds have been made for Dr. John K. Small's collection of native irises to test their hardiness in our climate and comprise about one hundred and twenty different "labels." This word is used in preference to "variety" as certain plants, supposed to be of the same variety but from different localities, may turn out eventually to be distinct.

Statistics follow:

COLOR PLANTING, BEARDED IRIS

Number of beds replanted	10
Number of plants set (about)	4150
Number of varieties	219

IN THE TEST BEDS

Number of beds replanted	5
Number of plants set	668
Number of varieties	201

NATIVE BEARDLESS IRISES

Number of beds planted	4
Number of "labels"	120
Number of plants set	473

IN THE COLOR BEDS FOR BEARDED IRISES THERE IS STILL SPACE FOR:

Bed	1.	6 plants.
Bed	2.	6, 27, 9 plants.
Bed	4.	21, 18 plants.
Bed	6.	15 plants.
Bed	7.	12, 8, 6 plants.

Bed 8. 6, 12 plants.
Bed 9. 72, 15 plants.
Bed 10. 12 plants.
Bed 11. 21, 15 plants.

Received from Mr. John C. Wister, 8 Mary Garden, 12 Caprice, 9 E. L. Crandall, 8 Nokomis, and 8 Albert Victor; from Mr. Arthur H. Scott, 45 Lady Foster, 9 Isoline; from Mr. Robert Wayman, 3 Ambigu, 3 Anna Farr; from B. F. Farr & Co., 6 Georgia; from Mr. Lester S. Lederer, 6 Caprice; from New Rochelle Show Garden, 9 Lent A. Williamson; from E. A. S. Peckham, 9 Innocenza, 21 Powhatan, 18 Montezuma.

About twenty plants of dwarfs of doubtful nomenclature were planted in Mrs. Hitchcock's garden for study.

ETHEL ANSON S. PECKHAM.

NEW LIGHT ON THE FLORA OF THE OLD AND NEW TESTAMENTS[1]

After reviewing all the literature written about the plants of Palestine in general and the plants of the Bible in particular and stressing the scantiness of the material, the lecturer sharply criticized the method accepted by students and scholars devoted to research of the plants of the Bible. That method is the comparative linguistic one, which depends upon linguistic similarity of different peoples. He pointed out how many great scholars had been led astray by this method: Tristram in the discussion of "Hyssop"; Kohut on "Zunin" in the Mishna; Dolman and Funck on "Zizania" in the New Testament; and the celebrated old scientist Emanuel Löw, who erred in a great many important questions, as, for instance, as to the identity of "The Rose of Sharon" (Habazeleth Hasharon), "The Lily of the Valley" (Shoshanath Haamakim), the "Lily of the Field," and others.

Against this method, the lecturer presented a series of new methods which are natural and specially linguistic, taking account of the synonyms and homonyms and "half synonyms" characteristic of Hebrew and Arabic. These methods should become of real value to students of the plants of the Bible.

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on June 6, 1925.

As an illustration of these methods the speaker chose several examples. One of these follow: In the Bible, plants are often mentioned in pairs, as "Naazuzim and Nahallalim," "Shamir and Shayit," "Kimosh and Hoah," "Shoshannah and Hoah," etc. These plants grow in Palestine today in the same botanical associations as in the days of the Bible. If we recognize one of them—for example, the Hoah (the Thistle—in Arabic, "Hurfesh"), the second, Shoshannah, generally translated as Lily, appears here not as Lily but as the *Narcissus Tazetta.* Only by the aid of the above-mentioned method is it made known that the "Kimosh" is the Ammi.

The material of Arabic plant lore, unknown in the scientific world until now, was collected by the lecturer and his wife, who gathered their information directly from the mouths of the Arab peasant (fallah) shepherds, fishermen, and Bedouins—dwellers in tents and wanderers in the deserts. This material, as well as the new methods, open up new horizons for the investigation and understanding of the flora of Palestine and of the Old and New Testaments.

Another point of special interest in the lecture was the discussion as to whether the natural flora of Palestine of today is the same as that of the time of the Prophets. It was pointed out that, although there may be a few slight changes, fundamentally the natural flora in Palestine of today remains the same as in the days of the Prophets. If we can no longer hear the Voice of the Prophets, we can at least see the same plants, even in their identical associations which the Prophets and ancient Israelites had before their eyes and which became the symbols and parables of their special form of rhetoric.

Commentators and translators of the Bible, having been neither botanists nor naturalists, introduced many errors into their explanations and translations of the flora of the Bible into different languages. They brought into many places plants which never grew there. The Lily of the Valley and the Lily of the Field, as interpreted by them, grow neither in the valleys, nor in the fields, nor in any part of Palestine. The Harul, mentioned in Prov. XXIV, vs. 21, usually translated as Urtica (nettle) does not grow in open fields of Palestine, as all botanists know, but is nevertheless so translated in this verse. At times large trees of

ancient big forests like the Nahallulim and Naazuzim (*Quercus lusitanica* and *Quercus coccifera*) are turned into thistles and thorns! Or a lovely characteristic Palestine plant of the Wadis (brooks), the Hebrew "Bata" of Isaiah V, vs. 6 (*Vitex Agnus-Castus*) is converted into "waste places." It is not merely a matter of incorrect work in translation. It is of more important consequence. Because of incorrect translations and commentaries, we acquire incorrect ideas about the historic flora of Palestine and prejudice the understanding of the symbolic customs and soul of the Prophets.

Should we say, for instance, with the learned Löw, who in his very important book, "Die Flora der Juden," states that the *Habazeleth Hasharon* (Rose of Sharon) is the *Colchicum Steveni*, then the beloved one of the "Song of Songs" compares herself to the meanest flower of the land, to a poisonous plant which the Arabs call "Flower of the Snake." It is the lecturer's opinion, based upon recent excavations made in Palestine, that the Habazeleth Hasharon is not the Colchicum or the Rose, but is *Tulipa praecox*, which beautifies the Sharon in the spring now as in ancient days.

The same is true of the *Hyssop*. Should it be said with Tristram, who mentions the matter in his "Natural History of the Bible," that the Hyssop is the prickly *Capparis spinosa*, we will misunderstand the symbolism of the religious customs of the ancient Hebrews by saying that this prickly bush is the symbol of modesty. This plant was in reality the symbol of boldness. The Biblical Hyssop is the *Origanum Maru*, which is of modest color, of pleasant fragrance and is largely used by the people as a condiment. Here the lecturer interpolated the remark that modesty should be the condiment of all our work.

Or if the "Lily of the Field," as is often required by many scientists, must be a large flower of strident colors, we must assume that Jesus' aesthetic taste was not very refined. But if we understand that in reality the Lily of the Field is the modest Palestinian daisy (*Anthemis palestina*), and that it has a distinctive beauty not perceptible to everybody, the character and taste of Jesus appear in another light.

The speaker ended his lecture with two important propositions: 1st, To found an International Council to correct the mistakes in

the translations of the Bible, to eliminate the misinterpretations of the Book which millions of people read with confidence. The Council ought to have its headquarters in Jerusalem and to establish in America, which is both practical and spiritual, a committee which would make preparations for this world council. 2nd, To plant in Jerusalem a "Garden of the Prophets and the Sages" with branches in the botanical gardens of the great world centers, to make possible for the "children" of all the world, to all of whom the Prophets have addressed themselves, a better understanding of their ideas and sentiments.

EPHRAIM HA-REUBENI.

LILIES[1]

A general survey of the true lilies and their near relatives reveals that the lily family contains relatively few plants of importance as food and fibre crops. Of these the onions are perhaps most important. The young shoots of asparagus are among the delicacies of the spring season. Bulbs of certain of the true lilies are eaten by man, especially in China. The seeds of a *Ruscus* are used as a substitute for coffee. One member of the lily family, New Zealand flax, yields fibre. Several members yield medicinal products; of these, sarsaparilla (from *Smilax*) may be mentioned. The array of important economic plants in this family is, however, not a noteworthy one.

Man's chief interest in the lily family is in their use as ornamentals. The family is noted for beauty of flowers—frequently the flowers are both beautiful and conspicuous. Here are to be found the tulips, the hyacinths, the dog-tooth violets, the Mariposa lilies, the day lilies, and, of course, the true lilies.

Of the true lilies (the genus *Lilium*) as many as 400 different kinds or species have been described. Many of these are, however, rare and unknown in cultivation. Only about 50 kinds are known to flower growers, and of these about 25 kinds are well known.

The list of hardy lilies that are, with moderate care, easily grown in an ordinary flower garden about New York City is longer than most people suspect. It includes at least 15 species,

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on the afternoon of July 25, 1925.

as follows: the Madonna, certain varieties of the familiar Easter lily, the gold-banded lily (*L. auratum*), the showy lily (*L. speciosum*), Henry's lily, the tiger lily, the golden Turk's-cap, the leopard or panther lily from the Sierra Nevada Mountains, the wild yellow lily and the American Turk's-cap (two species wild about N. Y. City), the coral lily, the regal lily, the candlestick lily, the orange lily and the European Turk's-cap lily. All of these may be grown successfully in almost any well-drained, deep-loam garden soil.

It is generally considered that lilies thrive best and are most attractive when grown in association with other plants. For the low-growing and the more sun loving sorts a low ground cover such as the Japanese spurge is excellent. For the others interplanting with various perennials and low shrubs is satisfactory. A mulch of leaves may be added in winter. Thus the ground is kept cool and moist in hot weather and there is protection from freezing and thawing in autumn and early spring.

Perhaps the chief reason why one fails to establish lilies in the home flower-garden is the difficulty of obtaining sound bulbs in good condition for planting. Certain sorts are frequently infected with fungi that cause the bulbs to decay. Even the most hardy sorts do not always stand the treatment they receive during storage and shipment.

A few points of advice may be given to the prospective grower of lilies. There are at least 15 splendid lilies which will strive in almost any garden. Special effort should be taken to secure sound bulbs. Order bulbs direct from a grower or from an importer. Place the order early in the summer and ask that bulbs be delivered as quickly as possible. Have the ground thoroughly prepared in advance and ready for planting and plant immediately upon receipt of bulbs. Plan for proper interplanting both for the artistic effect and to provide suitable protection to the lilies.

All of the more hardy lilies were illustrated by colored lantern slides showing "close up" views of individual flowers and groups of plants in garden plantings. Numerous of the more tender sorts were also shown in lantern slides.

A. B. Stout.

THE AMERICAN OAKS

The twentieth volume of the Memoirs of the National Academy of Sciences, is a quarto of 255 pages and 420 plates by Professor William Trelease, describing and illustrating the Oaks of America. Copies may be secured from the Superintendent of Documents, Government Printing Office, Washington, at $3.25 per copy.

Professor Trelease has been engaged on the investigation leading up to this monumental publication since 1912, and has studied the specimens preserved in the larger herbaria of both the New World and the Old, and he has seen many of the species of the United States and of Central America in the field. Especial examination was given to the type specimens, photographs of most of these being reproduced on the plates accompanying the text; these types are widely scattered in the herbaria of the world, those of all the earlier authors being in Europe, especially in the collections preserved at Kew, Paris, Berlin, Geneva, and Vienna. But in order to know accurately just what the authors of the species had for study it was necessary to see them, and Professor Trelease accomplished this in most cases.

The total number of species recognized in the work is 371, of which 253 are Mexican; 84 inhabit the United States, 10 of them ranging into Canada; there are 26 in Guatemala, 17 in Costa Rica; further south the species are much less numerous, but they occur south as far as the Andes of Colombia, where four species exist; the Live Oak of the southeastern United States grows also in western Cuba. Knowledge of the Mexican and Central American Oaks was fragmentary and incomplete when Professor Trelease began his studies; in this work he has described and illustrated over 150 species new to science.

Many natural hybrids between related species exist, at least presumable hybrids, of these 51 are listed and their supposed parents indicated.

The information brought together in this book constitutes an invaluable contribution to knowledge of the genus *Quercus,* including the characters of vegetative and reproductive organs, economic considerations, relations to the other genera of the family Fagaceae and the geological history and evolution of the genus, and about 150 fossil species being reported, reaching back into the Cretaceous period.

N. L. Britton.

FLOWERS FOR THE SUMMER GARDEN[1]

Through Nature's preference for spring time we are most plentifully supplied with flowers then. Those who are unable to think of a garden until summer, however, at summer home, cottage or camp, can be adequately provided with flowers and fragrance, and those looking for healthful vacation employment can be supplied with work in the garden.

Of the flowers in bloom now (August 8) a simple selection reveals thirty kinds suitable for summer gardens. Of course there are others, but a list of ten flowering shrubs, ten herbaceous perennials (these first two classes for permanent summer garden) and ten annual flowers, with two or three flowering vines thrown in for good measure, can be relied upon.

Butterfly-bush, Chaste-shrub, Sweet Pepper-bush, Hydrangea, Sour wood, Rose of Sharon, Abelia, Blue Spirea, Lespedeza, Spiraea; Oswego tea, Blue Salvia, Stokes' Aster, Phlox, Speedwell, Rudbeckia, Golden Glow, Penstemon, Loosestrife, Strawflower; Snapdragon, Zinnia, Nicotiana, Petunia, Sweet Alyssum, Larkspur, Marigold, Scabiosa or Pincushion Flower, Blue Lace-Flower, Pinks; Clematis, Trumpet Creeper and Morning Glory are among the names for the summer gardener to learn.

Of the shrubs three are only partially hardy, that is, they are often killed back to the ground during a severe winter, but send up new shoots the next season and flower again. These are the Blue Spiraea or Caryopteris, an attractive blue flowering shrub of late summer, Lespedeza, which flowers the last of the month of August, and Butterfly-bush, which is just now covered with lilac-colored torches attracting the butterflies. These shrubs need practically no pruning, as they prune themselves.

Hydrangea, which is well known; the Rose of Sharon, with single and double flowers of all colors, which used to be common and should again be used freely; and the Chaste-shrub, or Vitex, of three kinds, which is just hardy in our New York climate and a beautiful blue-flowering bush at the end of July; are three strong types of tall or broad, robust shrubbery. Abelia flowers all summer long, and later has persistent reddish-brown foliage; Sour-wood is a flowering bush for Rhododendron groups or woody corners; and Clethra, the Sweet Pepper-bush, one for furnishing every situation with fragrance of its white spikes of bloom.

[1]Abstract of an illustrated lecture given at The New York Botanical Garden on the afternoon of August 8, 1925.

Perennial Flowers to Choose From

Monarda, or Oswego-tea, red, purple or pink.
Blue Sage, variety *azurea grandiflora.*
Stokes' Aster.
Veronica subsessilis, a deep blue speedwell now in bloom.
Purple Loosestrife, for wet spot, water-side or garden border.
Rudbeckia or coneflower.
Golden Glow, another Rudbeckia for yellow.
Perennial Phlox, for any color except blue or yellow.

Annual Flowers

Self-sown	*Hand-sown*
Petunia	Scabiosa
Snapdragon	Zinnia
Nicotiana	Marigold
Sweet Alyssum	Blue Lace-Flower
Larkspur	Poppies
Strawflower	China Aster

Vines

Jackman Clematis
Trumpet Creeper
Morning Glory
Cardinal Climber

Kenneth R. Boynton.

PUBLIC LECTURES DURING SEPTEMBER AND OCTOBER

The program of illustrated lectures given on Saturday afternoons at four o'clock in the Museum Building of The New York Botanical Garden during September and October is as follows:

Sept. 5. "Carnivorous Plants," Dr. J. H. Barnhart.
Sept. 12. "The Method of Seed Dispersal," Dr. H. A. Gleason.
Sept. 19. "Flowers for the Home Garden,"
Mrs. Wheeler H. Peckham.
Sept. 26. "Dahlias and Their Culture," Dr. Marshall A. Howe.
(Exhibit of living dahlias.)
Oct. 3. "The Cultivation of Wild Flowers and Ferns,"
Mr. Herbert Durand.

Oct. 10. "Autumn Colors," Dr. A. B. Stout
Oct. 17. "Some Plants with Attractive Fruits,"
Mr. K. R. Boynton.
Oct. 24. Keeping Plants in the Gardens and Borders Healthy,"
Prof. H. H. Whetzel.
Oct. 31. "The Origin and History of Soils," Dr. Arthur Hollick.

NOTES, NEWS, AND COMMENT

Dr. J. N. Rose, Associate Curator of the Division of Plants of the U. S. National Museum, spent the last week of August in studies in the herbarium and library of the Botanical Garden.

Dr. H. H. Rusby, Honorary Curator of the Economic Collections of the Botanical Garden and Dean of the College of Pharmacy of Columbia University, devoted two weeks of his summer vacation to making botanical collections in Nova Scotia.

Arrangements have been completed whereby the American Institute of the City of New York and the American Dahlia Society will hold an exhibition at the 104th Field Artillery Armory, Broadway at 67th Street, New York, from September 30th to October 2, 1925, inclusive. The American Institute will be celebrating its 94th Annual Exhibition, and with the American Dahlia Society, will stage "the largest agricultural and horticultural exhibition ever held in New York City."

A most helpful book for any one interested in the growing of dahlias is W. H. Waite's "A Little Book of Modern Dahlia Culture," recently published by The A. T. De La Mare Company of New York. It is a booklet of 126 pages ($1.65), crowded with the practical information accumulated in years of experience in growing and originating prize-winning dahlias. The book is dedicated to the writer's employer, Edward Dean Adams, in recognition of the generous encouragement that has resulted in "finer and better dahlias." Mr. Adams has been a member of the Board of Managers of The New York Botanical Garden since 1912.

Dr. P. A. Rydberg, Curator, returned on the 10th of August from a two months' botanical exploration of several of the higher mountains of the Alleghanies. He was accompanied by Mr. John T. Perry, a graduate student of the Massachusetts Agricul-

tural College at Amherst. The following mountains were visited: Panther, Snowy, and Spruce Knob, W. Va.; Shenandoah, Peaks of Otter, and White Top, Va.; Roan Mountain, Tenn.; Grandfather, Mount Mitchell, the Pinnacle, Craggy Mountains, Bald Knob, and Mount Pisgah, N. C. About 3000 herbarium specimens were brought home and 150 numbers of living plants were mailed from the field.

A fine specimen of the fungus commonly known as "tuckahoe" has recently been received from Dr. F. A. Wolf of the North Carolina Agricultural Experiment Station. The specimen is accompanied by the following statement:

"I am sending to you under other cover, a large tuckahoe which weighed in the fresh condition, 4½ lbs. This specimen came into the laboratory on July 2, and a week later had formed a fruit body which you see at one end of the specimen. I have tried to wrap the specimen carefully so that it would reach you in good condition. Some time ago, I promised to send to The New York Botanical Garden for its popular exhibit, a fruiting specimen, in case one came to hand. The one which is being sent to you is much the best one which I have yet developed. It has the additional interest of having been formed on a corn stalk. You can see in the cortical tissues, remnants of the rind of the stalk. You can note, too, that the joint or node occurs at the middle of the tuckahoe."

This specimen is a valuable addition to our mycological exhibit.

The lecturer at the Botanical Garden on the afternoon of Saturday, August 29, was Mr. Le Roy Jeffers, F.R.G.S., one of the best-known of American mountain-climbers, his subject being "Scenery of our Western Mountains." Mr. Jeffers has gathered 63 mountaineering, outdoor and scientific organizations into the Associated Mountaineering Clubs of North America, and as Secretary of this organization he is working for the preservation of our finest scenery from commercial ruination. He had just returned from a 12,000 mile trip through our Western scenic regions. On this trip he visited the Northwest and viewed the Redwood groves of California, which the Save the Redwoods League is endeavoring to preserve. He then visited the Hawaiian Islands, viewing many of their most striking mountains and canyons, some of which he is endeavoring to have included in the Hawaii National Park. On several occasions Mr. Jeffers viewed

the mountains from an airplane, reaching elevations of 10,000 to over 18,300 feet. Among the regions referred to by the lecturer were little-known portions of Colorado and the Southwest; the volcanoes of the Northwest; the Redwood forests of California, and the tropical scenery of the Hawaiian Islands. A large number of strikingly beautiful colored slides illustrating these regions were shown.

The following "news circular," which is of interest to many of the readers of this journal, was issued to the press of the state by the New York Agricultural Experiment Station at Geneva on August 1, under the heading "Why Trees Fail to Bear:"

"Failure of tree fruits, particularly apples, pears, and cherries, to set fruit is now generally recognized as due largely to a lack of suitable pollen to fertilize the fruit blossoms, say specialists at the State Agricultural Experiment Station, where studies of this problem have been in progress for the past two years in coöperation with The New York Botanical Garden. Opinions differ widely as to what varieties are or are not self-fruitless, as well as which varieties are most effective for interplanting as pollinators, it is said, but definite information on the reaction of the pollen of different varieties will make consistent fruit yields more certain.

'During the past two years The New York Botanical Garden has been coöperating with the Department of Horticulture of the State Experiment Station to determine the pollination requirements of the different fruit crops, especially the more important varieties of apples, pears, and cherries,' says Dr. A. B. Stout, Director of Laboratories at the Botanical Garden, who has been devoting much of his time to this problem. 'Certain of the results already obtained are very definite and conclusive and have a practical bearing on how varieties must be interplanted if maximum crops are to be obtained.

'For these studies certain trees have been enclosed in cheesecloth tents at blossoming time and hives of bees placed within the tent during the blooming period. This was done to insure fertilization of the blossoms by their own pollen and to exclude outside pollen. Blossoms were also pollinated by hand with pollen from different sources and the blossoms protected by paper bags. By this means some very interesting conclusions have been reached regarding the reaction of various varieties to pollen from different sources.

'For one thing, it has been discovered that such well-known varieties of apples as McIntosh, Gravenstein, Rhode Island Greening, Delicious, Red Gravenstein, and Cortland are decidedly self-

fruitless, that is, will not set fruit to their own pollen. Likewise, it has been found that pollen from McIntosh will fertilize Cortland quite well, but that Cortland pollen is not suited to McIntosh. Wealthy and McIntosh appear to be especially well suited to each other and are recommended for interplanting. Another interesting discovery was that Baldwin pollen failed to set fruit on both Wealthy and Rhode Island Greening.

'Obviously, self-fruitless varieties should never be set in solid blocks. Also, only those sorts should be used for interplanting which are known to be good pollinators. The present investigations. which are to be continued, should furnish information upon which definite recommendations may be made as to suitable varieties for interplanting.

'With respect to the work with cherries, it was noted that Black Tartarian was decidedly self-fruitless, but responded well to pollen from Windsor. The Bartlett pear also failed to set fruit satisfactorily to its own pollen, but gave good results when pollen from Winter Nelis was used.' "

Meteorology for July. The total precipitation for the month was 7.89 inches. The maximum temperatures recorded for each week were 93° on the 5th, 95.5° *on the 12th,* 89.5° on the 13th and 87° on the 24th. The minimum temperatures were 52.5° on the 1st, 61° on the 9th, 55° on the 18th and 57° on the 24th.

Meteorology for August. The total precipitation for the month was 1.94 inches. The maximum temperatures recorded for each week were 86° on the 3d, 91° on the 8th, 89° on the 14th and on the 18th, and *94 on the 26th.* The minimum temperatures were 56° on the 8th, 60° on the 12th, 50° on the 22d and *48° on the 29th.*

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THE NEW YORK BOTANICAL GARDEN
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VOL. XXVI OCTOBER, 1925 No. 310

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

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ACCESSIONS

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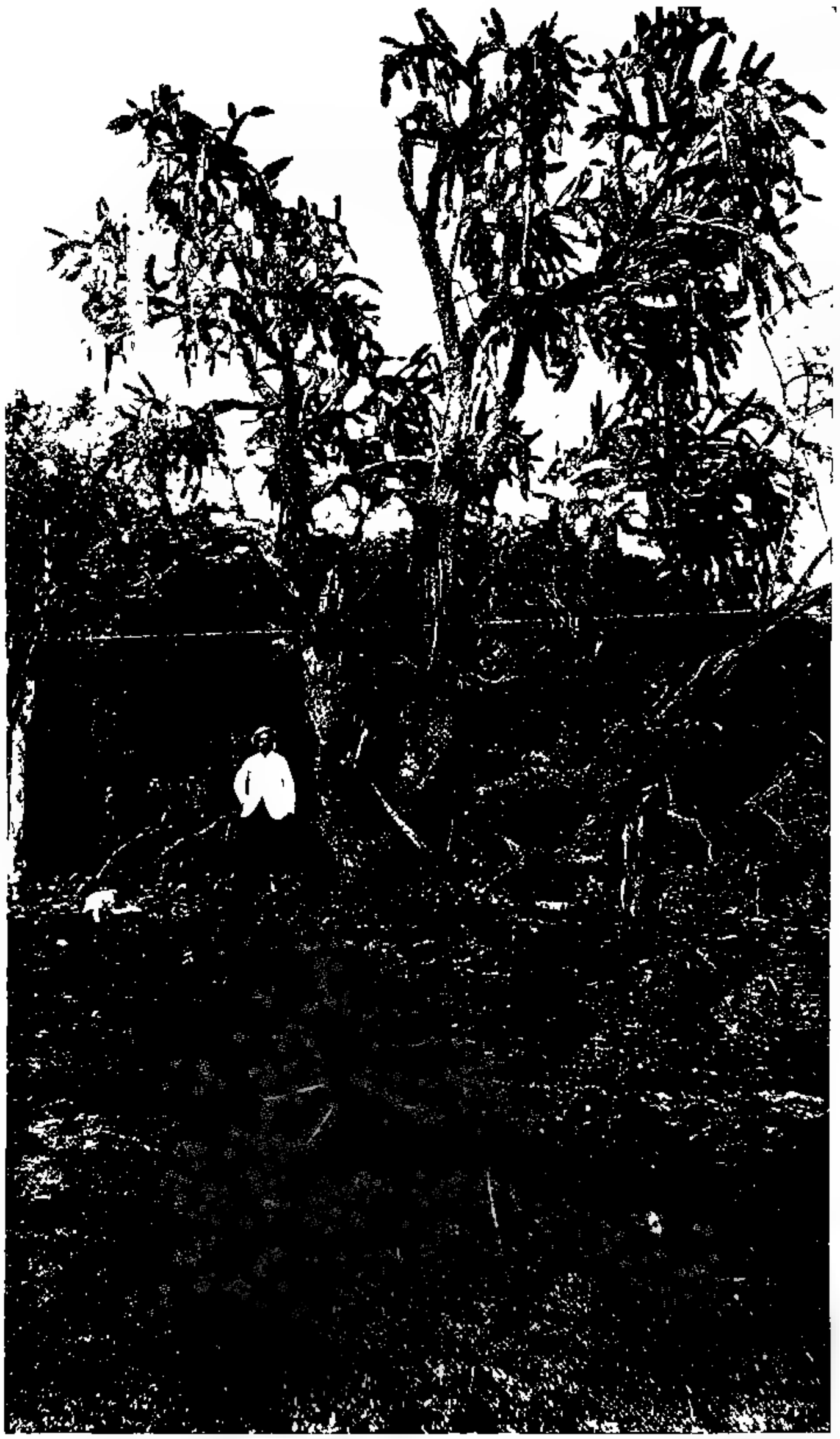
THE TREE-CACTUSES OF THE WEST INDIES

A gigantic cactus, in form reminding the observer, at some distance, of a large apple-tree, is a characteristic plant of coastal regions in central and eastern Cuba. Among localities where it may be seen, without very great inconvenience, are those between Rio Cojimar and Playa de Bacuranao, on the northern coast a few miles east of Havana, and at Vanadero, near Cardenas; on the southern coast near the narrow picturesque entrance to the Bay of Cienfuegos, and on the reservation of the United States Naval Station at the Bay of Guantanamo. This very wonderful plant was first made known to science by the late Dr. George Engelmann in 1869;[1] he studied fragmentary specimens collected by Charles Wright, probably near Havana, in about the year 1854, and described them under the name *Cereus nudiflorus*. Its Cuban name is flor de copa. It was observed and photographed in eastern Cuba by Baron Eggers and Mr. Theodore Brooks in 1888.

In 1907, Dr. William R. Maxon, of the United States National Museum, visited eastern Cuba, and made the first detailed studies of the plant in life; Dr. Rose published an account of it, with illustrations, using his specimens;[2] additional information concerning it was obtained from 1909–1912 during field work of The New York Botanical Garden in Cuba;[3] in 1912 Brother León, of the College of La Salle, Havana, studied the locality east of that city.

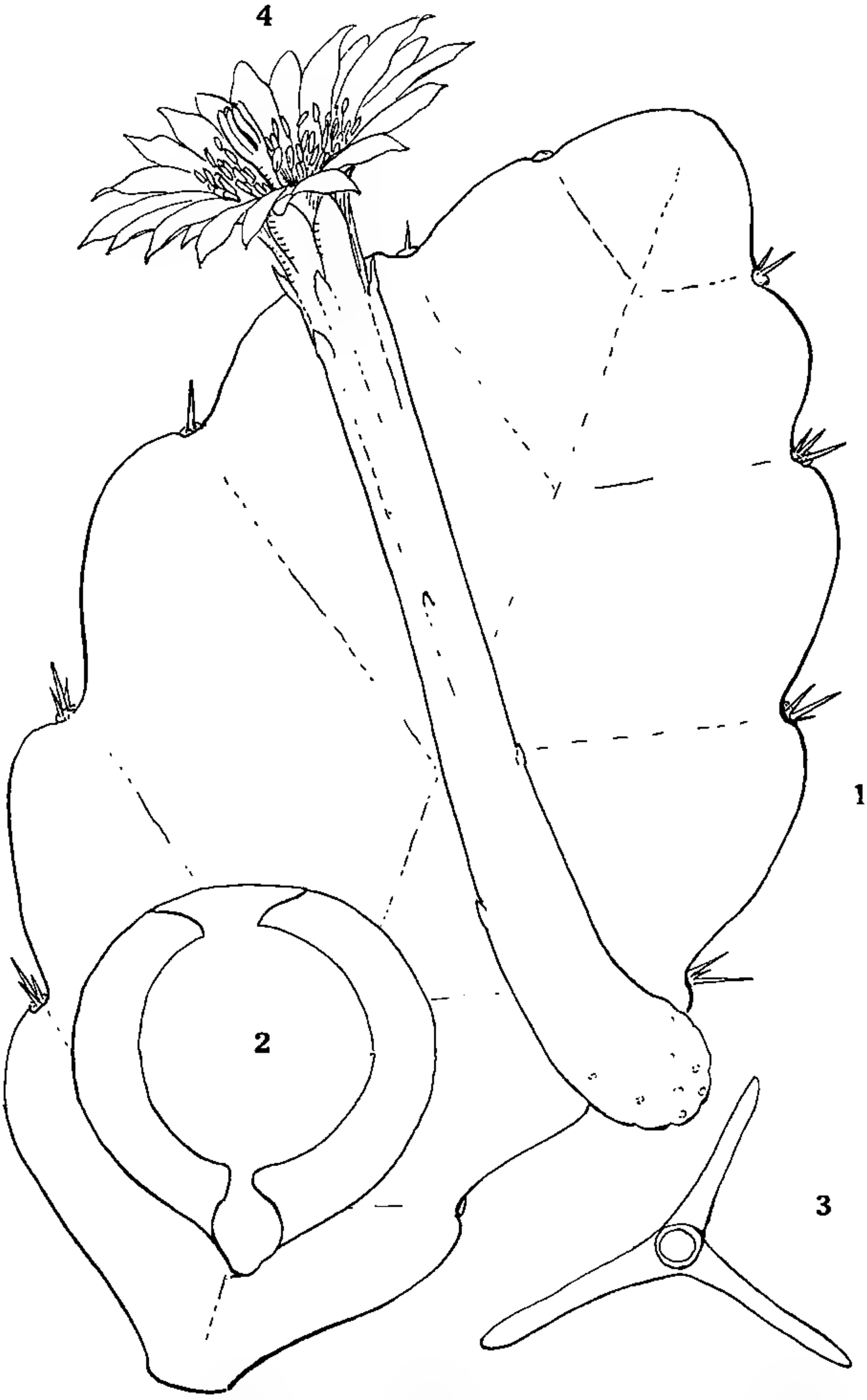
[1] Sauvalle, Anal. Acad. Cienc. Habana **6**: 98. 1869.
[2] Contr, U. S. Nat. Herb. **12**: 397, 398. *pl. 49–51*. 1909.
[3] Jour. N. Y. Bot. Gard. **10**: 106. 1909.



Dendrocereus undulosus, along road between Port-de-Paix and Mous-tique, Haiti. Photograph by W. Buch.

In 1920, Dr. N. L. Britton and Dr. J. N. Rose, using the knowledge thus brought together, concluded that *Cereus nudiflorus* is a genus distinct from *Cereus*, and proposed for it the generic name *Dendrocereus*,[4] in allusion to its tree-like form and aspect.

[4] The Cactaceae **2**: 113, 114. 1920,



Dendrocereus undulosus, from sketches and specimens sent from Haiti by W. Buch. 1, a joint of a branch; 2, section of a fruit; 3, section of a joint; 4, a flower.

The plant forms a massive short spiny trunk, which repeatedly divides into many branches, the ultimate ones three-winged, somewhat elongated or short,[5] the margins of the wings crenate, bearing acicular spines or sometimes spineless.

In the year 1755 the famous French botanist, Charles Plumier, described in his rare old folio "Plantarum americanarum," a cactus as *Cactus ramosus, articulis oblongis, triquetris,*[6] and published a conventionalized illustration of it. He had previously, in 1703, included the species in his "Catalogus Plantarum Americanarum" without description and illustration; no botanical specimens of it were preserved, however, and Plumier's description and illustration long remained all the published information about the plant. In 1828, the eminent Swiss botanist, Pyramus de Candolle, using only this meagre knowledge but concluding that the species was distinct from all others, denominated it *Cereus undulosus.*[7]

Subsequent students of cacti have been of various opinions as to the relationship of this Haitian plant, the description and illustration by Plumier being insufficient for exact determination. In 1783, the eminent French botanist, La Marck,[8] suggested that it may be a variety of *Cactus Pitajaya* Jacquin, a plant now known to be the same as *Acanthocereus pentagonus,* recording that Plumier's plant grew along the road between Port-de-Paix and Moustique, Haiti; in 1920, Drs. Britton and Rose also suggested, doubtfully, affinity with this widely distributed plant[9] of the West Indies and continental tropical America.

Notes and specimens recently obtained by Mr. W. Buch, a pharmacist of Port-au-Prince, Haiti, from plants growing between Port-de-Paix and Moustique, Haiti, the original locality, and sent by him to Dr. Britton, have enabled us to recognize in this cactus, a second species of the genus *Dendrocereus,* and to frame the following description:

Dendrocereus undulosus (DC.) Britton & Rose.

Cereus undulosus DC. Syst. **3**: 467. 1828.

Cactus undulosus Kostel. Allg. Med. Pharm. Fl. **4**: 1393. 1835.

[5] The Cactaceae **2** 113, 114. 1920.

[6] Plant. Amer. 187, *pl. 194.* 1755.

[7] Prodr. Syst. Nat. Regni Veg. **3**: 467. 1828.

[8] Encycl. Meth. **1**: 539. 1783.

[9] The Cactaceae **2**: 123. 1920.

Tree-like, repeatedly branching, about 10 m. high, the main trunk stout, erect, very spiny. Ultimate joints 3-winged, light green, the wings deeply undulate, bearing clusters of acicular straight pale nearly erect spines 2 cm. long or shorter at the areoles; flowers white, narrowly tubular, 15–20 cm. long, with a spreading limb about 5 cm. broad, the ovary bearing a few tufts of short hairs, the tube nearly naked, 1–1.5 cm. in diameter, the segments of the limb oblong or oblong-lanceolate, obtuse, the outer ones much shorter than the inner; stamens very numerous; fruit globose-pyriform, yellow, hard, about 5 cm. in diameter.

Photographs sent by Mr. Buch show that this tree-cactus much resembles *Dendrocereus nudiflorus* in aspect, and cuttings which have been established at The New York Botanical Garden show that the joints and armament of the two species are similar, but the flowers of the Haitian species are much longer and more slender than those of the Cuban, their limb smaller and with fewer segments.

The rediscovery by Mr. Buch, of this rare and remarkable plant, lost to science for so many years, is of extreme interest. He has planted it in his garden at Port-au-Prince, where we hope it will thrive; the cuttings at The New York Botanical Garden are presumably the only plants otherwise under cultivation, or known outside of Haiti; they are unlikely, however, to make much growth in a greenhouse.

There is a third tree cactus, inhabitating Haiti, also first illustrated by Plumier on his *plate 192* of the work above cited. This was rediscovered by Dr. W. L. Abbott and Mr. E. C. Leonard, near Port-au-Prince, in 1920, studied by Drs. Britton and Rose, and described by them in 1921,[10] and received in time to be included in the appendix to "The Cactaceae."[11] This is *Neoabbottia paniculata* (Lam.) Britton and Rose, named *Cactus paniculatus* by Lamarck in 1783 and *Cereus paniculatus* by de Candolle in 1828. This becomes thirty feet high or higher and widely branching, but its armament, flowers, and fruits are quite different from those of *Dendrocereus*.

N. L. Britton,
J. N. Rose.

[10] Smithsonian Miscellaneous Collections **72**[9]: 3. 1921.
[11] Vol. **4**: 280, 281. 1923.

THE DISPERSAL OF SEEDS[1]

There are few features in the life of a plant which are more easily studied by direct observation or more interesting to the amateur than that of seed dispersal. Every one is familiar with the plumed seeds of the dandelion, blowing across our lawns and parks in spring, or with the thistle-down floating across our meadows in autumn. Many suburbanites have seen strange sorts of plants appearing in their gardens each year, or have had actual experience with the rapid spread of weeds. These familiar instances are merely common examples of the universal tendency of plants to migrate, the former showing the process, and the latter the results.

Possibly because it can be so easily observed, the migration of seeds is a favorite subject in nature study, since even the children can appreciate that the plants are traveling and can grasp something of its significance. Probably for the same reason, seed dispersal is largely neglected in the more technical classes in botany in our colleges and secondary schools. Any observant rambler of the woods and fields during summer and autumn has excellent opportunities to observe not only the method of seed dispersal but also the results, as expressed in the migration of species, and, if he be somewhat philosophically inclined, will be led through his observations into ever wider fields of interesting deductions.

Seed dispersal is an essential part of the reproduction of our flowering plants. Reproduction consists in the production of numerous small bodies capable of independent growth, their detachment from the parent plant, their migration into new localities, and their germination and growth into new individuals like the parent. Every kind of plant has some method of migration; in some, to be sure, it is rather inefficient, but in others some parts of the seed or fruit have been so modified or specialized that they become well-equipped organs for migration over considerable distances.

Such structures may generally be termed adaptations, a word which covers a multitude of meanings in biology, but which is

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, September 12, 1925.

commonly applied to any unusual or extraordinary structure or behavior, by which the plant is enabled better to endure or to utilize the conditions under which it lives. The numerous and diverse adaptations for seed dispersal are of peculiar interest, in that they are of no direct value to the parent plant. On the contrary, their production must require an outlay of energy by the parent which might conceivably be otherwise directed to its own benefit. It seems obvious that a dandelion plant will not be the least stronger or more vigorous next year for the production of a thousand parachutes attached to its thousand seed-like fruits, nor will the young dandelion plants which germinate from them be any healthier for their aerial experience. The benefit accrues to the dandelion species as a whole, enabling it to grow in new fields where it had not grown before and to spread, in a comparatively short time, across hundreds of miles of territory. Through these devices the dandelion, originally a native of Europe, has spread across the whole United States, the wild cherry has sprung up in countless trees along every roadside and fence, the Canada thistle and the Russian thistle have become pests in our northern states, the American prickly pear has overrun hundreds of square miles in Australia, and the wild oat and brome grass have colonized equally large areas in our western mountains. Even plants of tropical origin have come north as far as New York, where some of them have become common weeds in our lawns and gardens.

The devices employed by plants to assist them in their migrations are manifold and make use of almost every available means of transportation. In not a few cases the energy for the motion is supplied by the fruit itself. One of our familiar plants of moist woods and stream banks is the jewel-weed or wild touch-me-not, which bears in the autumn a peculiarly sensitive fruit. If this is barely touched at the end when ripe, it splits instantly into several strips, each of which curls up into a tight coil, and in the miniature explosion the seeds are thrown out to a distance of several feet. The witch hazel, a common shrub of our vicinity, bears small hard fruits which soon open and show the ends of two hard black seeds. As the pods get drier by exposure to the dry air of October, they begin to shrink and exert a considerable pressure on the seeds until finally they are discharged like miniature bullets to a distance as great as forty feet. The pods of our

wild bean split lengthwise when ripe into two halves, each of which twists so suddenly that the seeds are thrown to a considerable distance. Many tropical members of the bean family carry the same adaptation much farther, bearing heavy woody pods which twist, when the halves are separated, with great force, expelling the seeds to a long distance.

The explosive action of most fruits depends on the production of two layers of tissue in the wall of the fruit, one of which shrinks more than the other in drying. As long as the fruit is intact, this shrinkage is prevented, and produces merely a considerable strain on the fruit. But when the fruit is broken or split, actual shrinkage takes place immediately, resulting in the twisting or coiling of the fruit and the consequent violent ejection of the seeds.

While these methods of self-propulsion are interesting, they are by no means as efficient in covering long distances as some others which depend on outside sources of energy. For lengthy migrations, plants depend naturally on one or another of three general methods, wind, water-currents, or animals, while the longest migrations of all are made through railway trains, steamships, and other agencies of commerce. Special adaptations are extensively developed for the first three methods, but not for the last, which represents a new and modern phase in the migration of plants.

A surprisingly large number of plants are distributed by the wind, and all present the same general features of comparatively light weight and large surface. In some, the seeds are so minute as to blow through the air like dust. Orchids are noted for their small seeds, which may be so minute as to require over seven million to weigh an ounce, and in several other groups the seeds are almost as microscopic. At the opposite extreme, we have such plants as the tumbleweed, where the whole plant breaks off at the ground when mature, and blows across the open fields, scattering its ripe seeds as it tumbles. A single large tumbleweed may produce as many as three million seeds, so it can be readily appreciated that they have every chance for efficient distribution.

In our most conspicuous examples of wind-distribution, the seeds bear some special attachment. The dandelion, thistle, clematis, and milkweed bear a large number of fine hairs which re-

tard the rate of fall by their resistance to the air and give the wind a chance to carry the seed a long distance before it reaches the ground. Such seeds may well be compared to a parachute. In others of the same type, the resistance of the numerous hairs is actually greater than the weight of the seeds. Such seeds may be compared to balloons; they are immune to gravity and drift through the air until actually blown upon the ground. The seeds of the elm and catalpa are flat, with wings at the ends or all around, and may be compared in their structure and behavior to a glider, or motorless aeroplane. Lastly, the fruits of maple and ash revolve rapidly when falling, reducing the rate of fall and giving the wind a chance to carry them to a considerable distance. These, to carry the comparison further, may be likened to a helicopter.

Distribution by water-currents is normally limited to such plants as regularly grow by the side of rivers or on the beach of the ocean. Their seeds or fruits exhibit regularly a light corky tissue, which makes them float, protected by a thin but essentially waterproof layer which prevents them from becoming water-logged. Falling into the water when ripe, they float with the current until they are stranded on the river bank or are washed ashore by the tide. The giant ragweed, which now is so common in our vacant lots in New York, is regularly distributed in this way, and its natural home is in the low land along rivers, subject to inundation every year. The water lily, the water marigold, and many other species of our ponds and swamps have similar floating seeds. Many plants of tropical seashores are distributed in this way, and a short search along a tropical beach will usually show twenty or more kinds of seeds and fruits washed up by the tides. This habit is usually considered the reason for the wide dispersal of most kinds of tropical strand plants, and there is some evidence that a few species have actually migrated across the Atlantic from Africa to South America in this way. It is well known that numerous such seeds and fruits have been carried north by the gulf stream, and finally washed ashore in Norway, Ireland, or France, but in such a long trip the salt water penetrates the protecting wall and destroys the vitality of the seed.

Some plants float free on the surface of fresh water and frequently make long migrations as a result. The quiet bayous of

the Illinois River are covered with acres of the little floating duckweed. Sometimes a strong wind from the proper direction blows millions of them out into the current, where they at once start down stream toward the Gulf of Mexico. Five hundred miles below, masses of duckweed as much as a hundred feet long may still be seen, floating quietly down the Mississippi. Standing on the famous Bridge of Spain in Manila, one may see a steady procession of plants of the water lettuce, floating down the Pasig River and soon to lose their lives in the salt water of Manila Bay.

Dispersal by animals is carried on in several ways. Every one knows the habits of squirrels in carrying nuts and burying them. Many of them are forgotten and germinate next spring. The rapid spread of oak forests in some of our prairie states is supposed to be due to similar activities by chipmunks. Birds have been observed to carry acorns across the English Channel. Three centuries ago, the Dutch tried to secure a monopoly of nutmeg in the island of Banda by exterminating all the wild trees. They found their efforts were unavailing, since new trees continually sprang up from seeds carried by wild doves. Even ants carry seeds to their nests, and in some cases devour only a part of the hull, leaving the seed still able to germinate. It has been stated that our well-known bloodroot is distributed in this way. Water birds carry large numbers of minute seeds in mud adhering to their feet, as was long ago shown by Charles Darwin, who found over seventy seeds in a single ounce of mud which he took from the feet of birds in the public markets. Many of our swamp plants bear minute seeds capable of dispersal in this way, and it is quite probable that their wide geographic range can be so explained.

A second type of animal dispersal is found in our numerous plants which produce an edible fruit with indigestible seeds. The free dispersal of wild grape, wild cherry, poison ivy, and red cedar are all due to this means of migration. Fruits of the common barberry are relished by many birds, and as a result it has become scattered along fence-rows and hedges far from the gardens where it had been planted by man. Since the barberry is parasitized by the destructive rust of wheat, the Department of Agriculture attempted, as a war measure, to exterminate the barberry throughout the wheat belt, and large sums of money were

spent in the attempt to overcome its very efficient method of dispersal.

The most conspicuous method of dispersal by animals, in which the human being plays an unwilling part, is through stick-tights, or fruits which adhere to the fur of animals or the clothing of man. It has been estimated that one species out of ten migrates in this way, and our own experience teaches that a walk through our woods or fields in the autumn will cover our clothing with several different kinds. Sooner or later these seeds are brushed off against other plants, or are picked off by hand, but they have had their ride and are then ready to grow in a new locality.

None of these agencies enables a plant to bridge the oceans or to cross a continent at a single leap. There the agencies of commerce are all-important and have led to the almost cosmopolitan distribution of many kinds of weeds. A ship takes on a load of earth, laden with seeds, as ballast, and dumps it in some foreign port. If the climate is at all like that of the home port, some of the seeds grow. Hay or straw, more or less mixed with weeds, is used for packing material. The boxes are shipped far away, the packing discarded, the seeds germinate, and the weeds are established in a new home. Weeds grow in a clover field, their seeds are threshed with the clover, and sold with the clover seeds. The seed is planted in a distant country and some other undesirable plants have made a long but successful journey. In ships, in freight cars, in wagons, and in automobiles, hundreds of species are even now traveling about the world. Every seaport, every freight-yard, every mill which uses agricultural products, every farm which buys seeds has become a natural plant-introduction station. Nearly seven hundred alien species have been found in the vicinity of New York, and there are similar large numbers of them about every large city.

H. A. Gleason.

THE DISMAL SWAMP OF VIRGINIA[1]

The name Dismal Swamp of Virginia is somewhat of a misnomer, for the reason that it lies partly in the state of North

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, August 22, 1925.

Carolina; but it was always more easily accessible from the Virginia side, and a majority of those who have visited or explored it have entered from Virginia, hence the linking of the name of that state with it. Also the fact that one of its most striking features—Lake Drummond—is wholly within the boundaries of Virginia has had more or less to do with the fixation of the popular name.

I assume that every one here has read or heard something about the swamp. It may be found described in various government reports; many historical events are connected with it; it figured more or less prominently in connection with certain events of colonial days and of the Civil War; it has been made the subject of numerous traditions; and it has served as the background for several poems and works of fiction, and many popular magazine and newspaper articles.

The area of the swamp is about 1,500 square miles, or about 300 square miles greater than the state of Rhode Island and about twenty-seven times the size of Staten Island. Its surface is almost level, sloping gradually from the southwest towards the northeast with an elevation above mean tide level of only about 12 to 22 feet. In consequence, its drainage is so imperfect that it may be likened to a gigantic sponge that remains constantly water-soaked and more or less inundated throughout most of its extent. Certain portions, however, become more or less dry in periods of drought, and quite a large portion of its former area —some 700 square miles along its eastern border—has been permanently reclaimed by means of drainage ditches and canals, in recent years, and converted into farming land.

Near the center of the swamp is Lake Drummond—an almost circular body of fresh water, about 2¾ by 3 miles in diameter, with an almost uniform depth of about 6 feet. The surface of the lake is now a little less than 20 feet above mean tide level; but previous to the completion of recent drainage operations it was somewhat higher. The lake may be reached during times of high water—that is, during and after rainy periods—by means of Washington and Jericho ditches. These were cut through the swamp many years ago for lumbering purposes. They are navigable by small row boats, which are propelled mostly by poling, as they are more or less choked by vegetation and by trees that

have fallen into and across them. A journey along one of these ditches, through the heart of the swamp, is an interesting and fascinating experience, as it affords opportunity to observe the wild life, both animal and vegetable, at close range.

In recent years, however, the construction of the Dismal Swamp Canal has provided a permanent, broad channel which is destined to be made a part of the great interior water-way that is to extend from New Jersey to Florida. This canal is navigable by steamboats of small size. It is connected with Lake Drummond by means of a " feeder "—a wide cut channel navigable by row boats, motor boats, etc. There are two locks between tide water and the lake—the lower or saltwater one at Deep Creek, and the upper or fresh water one about three-fourths of a mile from the lake.

The water of the lake is yellowish-brown in color, but clear, having very much the appearance of strong tea, and is said to possess wonderful antiseptic properties, due to the humic and other organic acids in solution. It is perfectly palatable and wholesome and almost odorless. It was formerly much used on ship-board, especially when long voyages were in prospect, as it had the reputation of never becoming foul.

Along and adjacent to the banks of the waterways are many dense thickets of cane-brake. The forest trees, that form the mass of the vegetation, consist largely of red maple, sour gum, persimmon, willow oak, ash, magnolia, white cedar, and bald cypress. The last constitutes the most conspicuous and striking arborescent feature of the swamp, which seldom fails to excite the wonder and admiration of every observer, especially when seen for the first time. It is one of the most remarkable of all our eastern forest trees. The massive buttressed base; the peculiar excrescences known as " knees," that arise from the roots; the tall, straight trunks, and the delicate feathery foliage, mark these trees as unique, in their way, as are the Sequoias and Redwoods of California.

At night a weird phenomenon is represented by the luminescent glow of " fox fire " on the stumps and decaying débris of the forest floor. It is not uncommon in other localities, but appears to be unusually abundant and brilliant there. It is commonly called " phosphorescence," but this term is a misnomer, as the

phenomenon is not due to phosphorus but to oxidation in connection with certain fungi and bacteria.

The lecture was illustrated by about thirty lantern slides that showed the topographic features of the region, the location of the ditches and other waterways, the characteristic vegetation, etc., mostly made from photographs taken by the lecturer in the course of a two days' trip from one side of the swamp to the other.

ARTHUR HOLLICK.

AUTUMN COLORS[1]

This lecture is given at The New York Botanical Garden each year during the season of autumnal colorations. Numerous beautifully colored lantern-slides have been made especially for use in this lecture. Some of these show general scenic or mass effects, others show the colorations that are characteristic of individual species which grow wild about New York City or are introduced in culture, and others show particular features in the development of the colors. Altogether they are representative of the views of autumn and of the various types of autumn colorings.

The main colors of the foliage of plants in autumn are red, yellow, and brown in various shades and intensities, with rarely white. Combinations of two of these give many intermediate shades.

In discussing the how and why of autumn colorations, it is to be noted that the color changes are associated with the death and fall of leaves. This is in general a response to the approach of unfavorable conditions, or as we often state it, a preparation for winter. The leaves of the ordinary deciduous trees, which yield our most noticeable colorations, are rather tender organs. They grow rapidly, they contain much soft pulpy tissue, and they die quickly when dried out or when frozen. They are weak parts of a plant when unfavorable conditions approach. Thus, with the coming of autumn the activity of the leaves ceases, they begin to die, and the food materials in them are transferred into the stem.

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden, Saturday afternoon, October 10, 1925.

A fallen leaf is practically devoid of food substances that are of immediate use to a plant. The skeleton of the leaf is left, together with certain residue substances, most of which are insoluble, in the sap of plants. It is due to various physical and chemical changes in the residue or waste products that the autumn colors in foliage develop. The yellows are chiefly derived from the green pigments that prevail during summer. The residue of sap pigments gives the reds, and these are influenced greatly by kinds and amounts of acids that are present.

Light is an important factor in the development of autumn colors. A leaf of the red maple or of the sumac develops no flaming red or rich yellow coloration if artificially darkened just before it is about to change in color. If a part of a leaf is covered, that part remains greenish and changes to dull brown while the rest of the leaf changes to rich golden or crimson. Dull cloudy periods of weather are not productive of the most brilliant colorings.

It is sometimes claimed that heavy frosts are necessary for the development of autumn colorings. Throughout the more northern states there is usually a heavy killing frost early in September or even in August. No doubt such a frost hastens the color changes and the fall of leaves. But here about New York City, there is seldom a killing frost until late in October. The foliage of many of our trees, shrubs, and herbs passes through brilliant colors and the leaves fall before there is a freezing temperature.

Evergreen trees drop a crop of leaves each year quite as do deciduous trees. The difference is that they do not drop all their leaves. Autumn colors develop on the crop that is to fall, but these are usually the more delicate and subdued shades of yellow and brown. Autumn colorings are especially conspicuous in the white pine.

It is, perhaps, correct to say that nowhere on the earth are autumnal colorings better than in the region about New York City. Here there is a wealth of deciduous trees and shrubs that possess pigments which give the color changes. The weather conditions in autumn often give many clear, cloudless days with bright sunlight. The change from a moist warm summer favorable to the activity of plants to a cool autumn with temperature unfavorable to leaf activity and life is rather abrupt.

If autumnal coloration occurred at rare intervals, let us say once in 25 years, we would certainly regard it as among the most wonderful phenomena of nature. But coming as it does each autumn with regularity, we are likely to fall into the habit of viewing it as a matter-of-course event.

A. B. STOUT.

PUBLIC LECTURES DURING NOVEMBER

The following is the program of free illustrated lectures given at 3:30 on Saturday afternoons in November in the Museum Building of The New York Botanical Garden:

Nov. 7. "Beautiful Gardens of New York State."
Mrs. John W. Paris.

Nov. 14. "Seeds as Carriers of Disease." Dr. C. R. Orton.

Nov. 21. "Original Exploration of the Yellowstone National Park." Prof. John M. Coulter.

Nov. 28. "Botanical Features of Ceylon." Dr. H. A. Gleason.

NOTES, NEWS, AND COMMENT

Dr. L. O. Overholts, from Pennsylvania State College, has recently spent a few days at The New York Botanical Garden, completing his manuscript on the higher fungi of Porto Rico.

Dr. W. J. V. Osterhout, who has held botanical professorships in the University of California and Harvard University, has begun his new work as a physiological investigator in the Rockefeller Institute for Medical Research in New York.

Professor John M. Coulter, for many years head of the Department of Botany of the University of Chicago and, since its initiation, Scientific Adviser of the Boyce Thompson Institute for Plant Research, has recently become a resident of Yonkers.

Mr. Rafael A. Toro, who held a research scholarship at The New York Botanical Garden for two months during the summer, has returned to his home in Porto Rico, where he will take up his

work as Assistant Plant Pathologist, in the Agricultural Experiment Station at Rio Piedras. Mr. Toro will be associated in this work with Dr. Mel T. Cook, formerly of Rutgers College, New Jersey.

The following visiting botanists have registered in the library during the summer months: Mr. John T. Perry, Amherst, Mass.; Mr. Adriance S. Foster, Bussey Inst., Forest Hills, Mass.; Dr. Ivan M. Johnston, Gray Herbarium, Cambridge, Mass.; Prof. F. H. Blodgett, Danbury, Conn.; Prof. H. H. Whetzel and Mr. Edwin E. Honey, Ithaca, N. Y.; Dr. Alwin Berger, Geneva, N. Y.; Mr. John M. Fogg, Jr., University of Pennsylvania; Prof. L. O. Overholts, State College, Pa.; Miss Claribel R. Barnett, Dr. Walter T. Swingle, Dr. Edgar T. Wherry, Dr. Neil E. Stevens, Mr. E. G. Arzberger, and Mr. Peter Bisset, Washington, D. C.; Mr. Donald C. Peattie, Rosslyn, Va.; Prof. W. C. Coker, Chapel Hill, N. C.; Prof. J. C. Arthur, Lafayette, Ind.; Prof. John T. Buchholz, Fayetteville, Ark.; Prof. Geo. B. Rigg, Seattle, Wash.; Mr. Harold H. Clum and Mr. Rafael A. Toro, Rio Piedras, P. R.; Mrs. Frances W. Horne, Mayagüez, P. R.; Mr. John R. A. McMillen, N. S. Wales, Australia; Prof. J. Henry Burkhill, Singapore, and Prof. H. H. Hu, Southeastern University, Nanking, China.

Dr. F. O. Bower, who has recently retired from the Regius professorship of botany in the University of Glasgow, is spending two months in filling lecture engagements in the United States. He is well known to American scientists as the author of a "Course of Practical Instruction in Botany," "The Origin of a Land Flora," and various monographs on plant morphology. Professor Bower has made several visits to The New York Botanical Garden and he was the guest of honor at a dinner given by Dr. N. L. Britton and Professor Robert A. Harper at Sormani's Restaurant on the evening of October 5. Forty-eight men, representing the Boyce Thompson Institute for Plant Research, The New York Botanical Garden, the Brooklyn Botanic Garden, the Rockefeller Institute for Medical Research, and the botanical departments of Columbia University, Princeton University, and Rutgers College, were in attendance. After-

dinner addresses were made by Dr. Britton, Professor Bower, Professor Harper, Dr. William Crocker, Professor John M. Coulter, and Professor W. J. V. Osterhout.

A new path, providing a beautiful and interesting walk through oak woodlands in The New York Botanical Garden has recently been completed and opened to the public. It is about 1,200 feet in length, leading from the eastern end of the Rose Garden southerly to Pelham Parkway, thus providing the most direct way from the Pelham Parkway Station to the Rose Garden, the gorge of the Bronx River, and the Hemlock Forest. It was partially constructed last year, and has now been economically completed, plenty of broken stone, and ashes for surfacing, being available without cost; thus only labor and cartage were required. The woodland traversed is nearly all red oak, black oak, and scarlet oak, and labels have been made and affixed to many of the trees. Native shrubs, such as Maple-leaved Viburnum, Witch Hazel, and Low Blueberry, form much of the undergrowth and wild flowers of many kinds are abundant in their seasons, White Wood-asters being in full bloom at this time.

Meteorology for September. The total precipitation for the month was 3.37 inches. The maximum temperatures recorded for each week were *88.5° on the 1st,* 85° on the 11th and on the 13th, 85° on the 14th and 82° on the 21st. The minimum temperatures were 59° on the 2nd, 55° on the 9th, 52° on the 18th, and *38° on the 26th,* on which morning there were traces of frost.

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GATHERING CACTI IN THE EASTERN COASTAL PLAIN

JOHN K. SMALL

FLOWERS FOR THE HOME GARDEN

ETHEL ANSON S. PECKHAM

THE FRINGED GENTIAN

GEORGE F. NORTON

PUBLIC LECTURES DURING DECEMBER AND JANUARY

NOTES, NEWS, AND COMMENT

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GATHERING CACTI IN THE EASTERN COASTAL PLAIN

A RECORD OF BOTANICAL EXPLORATION IN AUGUST, 1922

Shortly after the "Bimini" of the West Indian aborigines was christened "Florida" by Ponce de Leon in 1513, records of its natural history and economics began to appear—especially accounts of the plants used as foods and fibers. Thus Florida may well be considered the cradle of North American botany, so far as the mainland is concerned.

For example, we find records like the following in an account of The Journey of Alvar Nuñez Cabeza de Vaca (Translation by Ad. F. Bandelier, 1905):

"After which time they [de Vaca's captors] would remove to another section in order to eat prickly-pears. These are a fruit of the size of eggs, red and black, and taste very good. For three months they subsist upon them exclusively, eating nothing else."—Page 81.

"Their best times are when 'tunas' [prickly-pears] are ripe, because they have plenty to eat, and spend the time in dancing and eating day and night. As long as these tunas last they squeeze and open them and set them to dry. When dried they are put in baskets like figs and kept to be eaten on the way. The peelings they grind and pulverize."—Page 91.

"During all the time we ate tunas we felt thirsty. To allay our thirst we drank the juice of the fruit, pouring it first into a pit which we dug in the soil, and when that was full we drank to satisfaction. The Indians do it in that way, out of lack of vessels. The juice is sweet and has the color of must. There are many kinds of tunas, and some very good ones, although to me all tasted alike, hunger never leaving me time to select, or stop to think which ones were better. . ."—Pages 96 and 97.

Our recent studies and explorations in the eastern cactus field have taken us to numerous aboriginal settlements where now grow the descendants of the plants from which the old Indians once feasted, as described in the above quotations and which are thus doubly interesting to the writer.

The summing up of our knowledge of the cacti that came to light during general botanical exploration, particularly in Florida, during the past few years indicated the desirability of further studies in these succulents.

Specimens of our former discoveries had been brought together in the cactus plantation of Charles Deering at Buena Vista, Florida, and at The New York Botanical Garden. The number of genera and species multiplied to such an extent that it seemed desirable to make a public exhibit in the conservatories of The New York Botanical Garden and to replenish the plantings in the garden at Buena Vista. The execution of these plans was agreed to by all concerned and was made possible by the generous cooperation of Mr. Charles Deering. John W. Small assisted in the field-work throughout the trip.

A night's journey about the middle of August, from New York to Cape Charles and Norfolk, placed the writer amidst a southern flora. It was mid-season, yet there were quite a number of showy-flowered plants in evidence. The edges of the marshes were covered with extensive areas of loosestrife (*Steironema*) with countless nodding yellow flowers. On the higher land blue tick-seeds (*Meibomia*) and yellow partridge-peas (*Chamaecrista*) occupied the woods. Three exotic, but now widely naturalized, trees were in evidence in many places—a mulberry (*Morus*), the paper-mulberry (*Papyrius*), and the "acacia" (*Albizzia Julibrissin*).

In North Carolina the oak and beech barrens were often yellow with goldenrods (*Solidago*) or white with bonesets (*Eupatorium*).

A large grass—a cane (*Arundinaria tecta*)—quite different in habit from any of our northern grasses, occupied vast swamps and sometimes intermingled with the cat-tail (*Typha*) in marshes. Further on, the swamps were decorated with large colonies of wool-grass (*Scirpus cyperinus*), with its large tassel-like inflorescence supported high on slender stems. Wet ditches were oc-

cupied, often exclusively, by the Japanese honeysuckle (*Nintooa*), which has a habit of spreading rapidly and crowding out everything before it.

An elegant white hibiscus (*Hibiscus incanus*) was scattered through the wet open hammocks, and the trees of the higher hammocks were draped with Virginia-creeper (*Parthenocissus*), with its clusters of blue berries, and also with the trumpet-flower (*Tecoma*), with its clusters of long scarlet flowers and cigar-shaped pods.

The pine-barren swamps were often showy spots. The white fringed-orchis (*Blephariglottis*), meadow-beauties (*Rhexia*), foxgloves (*Agalinis*), and cardinal-flower (*Lobelia*) were scattered wide, while swamp-loosestrife (*Decodon*) and swamp-milkweed (*Asclepias pulchra*) were frequently masses along streams and ditches. The branches of inlets were the homes of the spatter-docks (*Nymphaea*), while the pond-lily (*Castalia*) thrived in the still water back in the woods. Here and there a pond was covered with the large leaves of the water-chinquapin (*Nelumbo*) —perhaps a remnant of an Indian occupation of that part of the country. The water-chinquapin and the pond-lily often grew in the same pond. The more conspicuous plants about the ponds were the turkey-beard (*Xerophyllum*), with its very numerous narrow basal leaves, the leopard-lily (*Lilium Catesbaei*), with its erect flower of a peculiar shade of red, and the white-fringed orchis (*Blephariglottis*), with its flowers creamy without and white within.

In thickets along ponds and ditches two plants—lead-plant (*Amorpha*) and poison-hemlock (*Cicuta*)—stood above the other vegetation, and a blue-tinged eryngo (*Eryngium*) was seen frequently. In the hammocks the sour-wood (*Oxydendrum*), which ranges from sea-level to the high mountains and is a source of celebrated honey, was plentiful. With it grew a tree-like herb or herb-like tree—prickly-ash (*Aralia spinosa*)—which is extensively used in medicine. The black-walnut (*Juglans*) with its celebrated fruit was here also, as it was in the mountains. In this region the long-moss (*Dendropogon*) appeared in abundance.

Two exotic cultivated and also naturalized trees were frequently in evidence, both of them very handsome when in flower. The one introduced from the East Indies long ago –the crape-

myrtle (*Lagerstroemia*), the other of rather recent introduction from Japan— the karri (*Paulownia*).

As we approached Beaufort, our first destination, the highest pineland was well bedecked with flowers. More conspicuous were the tall rosin-plants (*Silphium*) with their wand-like stems and the vari-colored horse-mint (*Monarda*) with its curiously tiered whorls of bracts and flowers.

At Beaufort, North Carolina, we were in the middle of a stretch of several hundred miles of coast line, botanically nearly or quite unknown—it has never been explored. Here began our cactus campaign.

There are two kinds of prickly-pears at Beaufort. The one, a so-called "joe-jumper" growing on the sand-dunes along the coast, is referable to *Opuntia Drummondii,* but with smaller berries than the long obconic-obovoid berries of the typical plant of the Gulf Coast further south. The presence of the other prickly-pear there is a puzzle. By some of the inhabitants it is said to be native, by others it is said to have been introduced from the coast region of western peninsular Florida more than half a century ago. The latter condition seems to be correct, in part. The plant is really a native of Mexico. It may have been brought to North Carolina by way of Florida. It is quite interesting, both on account of its hardiness and its name. Plants were long ago taken to Cambridge, England. They proved hardy there and were named *Opuntia cantabridgiensis*—Cambridge prickly-pear. Specimens are growing on the shore at Beaufort, but their future existence there is precarious. Plants have been transferred to the island occupied by the Station of the United States Bureau of Fisheries and also to the cactus plantation at Buena Vista, Florida.

In the vicinity of Beaufort, *Opuntia Drummondii* grows on the various islands lying off the mainland. It is plentiful on the dunes near the abandoned Fort Macon opposite the town. The only evidence of former arboriculture about the fort is the remains of a white-poplar tree (*Populus alba*) which produces a host of suckers. Among this small forest of suckers is an abundance of the Florida pellitory (*Parietaria floridana*). This region is the northern geographic limit of that species.

As we well understood the prickly-pears of the South Carolina coast, as far as they had been collected, we passed that region by,

and hastened to the coastal region of northeastern Florida. Our course lay through the botanically historic regions of New Bern and Wilmington, where some of our pioneer botanists were active a century ago. Goldenrods and bonesets were the ubiquitous plants in the pine woods. The swamps were filled with the spicy fragrance of the white-alder (*Clethra alnifolia*) which was then the flowering representative of associated shrubs.

High and low grounds alike had much in the way of floral display. The swamps were the more showy spots. The lower groups of plants were the more in evidence. There, even the widespread plants such as the fringed-orchis—yellow and white (*Blephariglottis ciliaris* and *B. Blephariglottis*)—and the rather locally distributed rarities, such as turkey-beard (*Xerophyllum asphodeloides*) and bog-feather (*Oceanorus leimanthoides*) grew in equal abundance. The bright-green of the foliage of the cinnamon-fern (*Osmunda*) and the sensitive-fern (*Onoclea*) was often a prominent factor in swamp and marsh. Marshes, too, were sometimes shimmering sheets of yellow, as a result of the myriads of flowering heads of the yellow-eyed grass (*Xyris*). In the pinelands the flowers were more individually showy, than collectively, as they were in the swamps. The butterfly-peas (*Bradburya* and *Clitoria*) and the still more showy and peculiarly built passion-flower—may-pop (*Passiflora incarnata*)—were all vines. The latter plant we had collected in flower also on the coastal dunes in Florida south of Coronado in the preceding April. Botanically, the most interesting plant, however, was a semi-vine a blueberry (*Vaccinium crassifolium*)—with a restricted geographic range in the Carolinas. From the yards of towns and homesteads the fruits of three kinds of trees –the paper-mulberry (*Papyrius*), the tree-of-heaven (*Ailanthus*), and the pride of-China (*Melia*) –scattered in various ways, had resulted in establishing the species as naturalized members of our flora. These three kinds of trees are natives of eastern Asia.

We established ourselves at Jacksonville for three days and made excursions to several points.

Saint Mary's in southeastern Georgia was first to be visited. The low pinewoods of the town were the most lively colored spots of the region. The more conspicuous plants were representatives of the highest family of the monocots and the highest

of the dicots. The former were four orchids of the pompom type, rein-orchis relatives, mostly fringed-orchis (*Blephariglottis Blephariglottis, B. ciliaris, B. lacera,* and *Gymnadeniopsis integra*). The dicots were represented by three or four kinds of boneset (*Eupatorium*), deer's-tongue (*Trilisa*), and a coreopsis relative (*Endorima*).

In and about Saint Mary's there occur three definite kinds of prickly-pears—(a) *Opuntia Pollardi,* the Coastal Plain replacement of the common prickly-pear of the North, *Opuntia Opuntia*; (b) the crow-foot prickly-pear (*O. Tracyi*) which crept over the lawn-like dune with its elongate slender strings of joints resembling so many green snakes, perfectly flat on the sod even to the tip joint; (c) a large-jointed prickly-pear tentatively referred to under the name *Opuntia stricta.* This is one of the larger-fruited species and it was doubtless one of the standard sources of food for the aborigines; (d) in addition to the above there occurs a plant with broader joints and smaller fruits than the so-called *O. stricta.* It may represent another species.

Saint Mary's itself is an old town. Its name appears in history between two and three centuries ago. It is almost as difficult of access now as it was then, and perhaps is not even now much more lively—surely not nearly as active as during some of our national crises, when it was a rather important naval base. Its antiquity is also evidenced by the spacious streets made at a remote time when land and labor did not command such high prices as they do today, and also by the gigantic introduced street trees, such as button-ball (*Platanus*), the catawba (*Catalpa*), the locust (*Robinia*), the Chinaberry-tree (*Melia*), and the pecan (*Hicoria*). The trunks of some of the pecan trees are nearly or quite three feet in diameter, which indicates that they represent some of the earlier trees brought in from the West. In addition to the above-mentioned trees, several of the native kinds—live-oak (*Quercus*), holly (*Ilex*), and laurel (*Magnolia*) are prominent features in yards and streets. Giant red-cedars (*Sabina*) are also there—because they were protected from the ax of the pencil-maker who began to devastate that region over a century ago.[1]

The most showy woody plant at Saint Mary's and in the Florida peninsula, except in the southern part, was the crape myrtle

[1] Journal of The New York Botanical Garden **24**: 5 and 6. 1923; **25**: 59. 1924.

(*Lagerstroemia indica*) which was introduced from the East Indies many years ago. It occurs in the South either as a small tree—with a single trunk or a large shrub—with a cluster of trunks. It has a smooth bark somewhat resembling that of the native pigeon-plum (*Coccolobis laurifolia*) and bears numerous showy clusters of purple or pink, or rarely white flowers.

Our first objective in Florida was Amelia Island, which is separated from Georgia by the estuary of the Saint Mary's River and from the mainland of Florida by a series of creeks and the Amelia River on the west. We drove from Fernandina to the extreme end of the island where Fort Clinch is situated. The only conspicuous flowering herbs on the sand-dunes were butterfly-pea (*Bradburya virginiana*) which climbed extensively over the low shrubs, and a stiffly erect spider-wort (*Tradescantia reflexa*) whose showy flowers had a faint fragrance, which, however, in no way resembled the strong rose-like fragrance of the spiderwort of the sand-dunes of the lake region. One clump of spider-lily (*Hymenocallis*), with a few flowers, was found in the midst of the dunes. This locality is only a few miles south of Saint Mary's where *Hymenocallis crassifolia,* described a century ago, was discovered and as yet remains a mystery unless the plants just referred to should turn out to represent that species.

But to return to cacti: Three different kinds, all common, are found on the northern end of Amelia Island. They are a many-flowered prickly-pear (*Opuntia* sp.) which will be mentioned particularly under our next objective point in the state; the crow-foot prickly-pear (*Opuntia Tracyi*) which we here found in flower a few years ago and in fruit on this occasion; and a large-padded prickly-pear (*Opuntia stricta*) found a day previous at Saint Mary's. This plant was used by the aborigines as a food; not only were the ripe fruits eaten, but the thick joints of the stem, or pads, were roasted and eaten. Their successors, the white man, not many years back, in preparing white-wash for fences and houses, used water in which these pads had been soaked in order to secure the mucilaginous matter which made the solution of lime more adhesive and durable when applied to a surface.

Towards the southern end of the island there occurred the largest prickly-pear of the Atlantic Coastal Plain. This species

which we have named (*Opuntia magnifica*) has no close relatives along the coast, but its habit suggests that it may be a naturalized plant, although we have no proof of this on the one hand and on the other, the residents on that part of the island claim that it is a native plant. Its flowers and fruits, too, are also larger than those of our other species. The pinelands on the southern part of the island were conspicuously decorated with two kinds of composites: a white boneset (*Eupatorium*) and a yellow goldenrod (*Solidago*). Weeds were very conspicuous along the highway, both the relatively low bitter-weed (*Helenium tenuifolium*) and the tall bladder-pod (*Glottidium vesicarium*) which, although an annual plant, often makes a woody stem over an inch in diameter. About the dwellings the common weed is often lion's ear (*Leonotis nepetaefolia*).

On the way back to Jacksonville we discovered two additional kinds of prickly-pears in the pine woods, the one, *Opuntia turgida,* first discovered several years ago south of Daytona and not known elsewhere, and *Opuntia lata,* also first discovered several years ago near Gainesville and heretofore confined as far as we know to the northern end of the lime-sink region.

Our next Florida objective was the vicinity of the mouth of the Saint John's River, where both kinds and individuals of prickly-pear rival or excel any other local cactus development in the state.

A day on the islands and on the mainland about the mouth of the estuary yielded much of interest. We first tramped the length of Fort George Island in the midst of which we found five colonies of the joe-jumper (*Opuntia Tracyi*). The plants, having grown rapidly after the recent rains, were vigorous and assurgent, instead of closely prostrate, which habit, of course, they would assume later. The large prickly-pear (*Opuntia stricta*), a plant of particular interest mentioned above and to be mentioned later on, was thriving on the shell middens close to the water. These plants had flowered and bore an abundance of fruits. A third kind of prickly-pear—*Opuntia* sp.—related to *O. ammophila,* grew in the open sandy flats about the middle of the island. This species is particularly abundant from Atlantic Beach to Daytona. Goldenrods (*Solidago*), hawkweed (*Hieracium*), and thistles (*Cirsium*) were the evident flowering

herbs associated with the prickly-pears. This island is the northernmost station for the wild-pepper plant, *Peperomia cumulicola.* As recorded in previous papers,[2] this succulent is a winter bloomer. In spots on the shell-middens where we had seen it on previous visits, the myriads of plants were in their resting stage. However, in the hammock about the middle of the island we came upon a patch an acre or two—of this wild-pepper plant in its winter stage and in full flower. Its normal schedule had become disarranged for some reason that was not evident to us.

The dunes at Pilot Town that face the estuary of the Saint John's are prolific in cacti. Within a small area the broad-jointed *Opuntia turbinata* and the narrow-jointed *Opuntia Tracyi, O. impedata,* and *O. pisciformis* may be found. The three latter are locally known as joe-jumpers. The first of the trio represents the smallest-jointed joe-jumper yet found in the eastern United States, while the last one is the largest-jointed one yet discovered anywhere. Two flowering plants only were conspicuous when we collected the cacti—the one a native Mexican-poppy (*Argemone intermedia*), with large immaculate corollas, and the other, a naturalized South American wild-sage (*Lantana Sellowiana*) with small, but rich purple flowers.

Atlantic Beach, which faces the Atlantic Ocean about six miles south of the mouth of the Saint John's, was our next objective. There the plain-like parts of the dunes back of the barrier-ridge are a riot of prickly-pears. Three kinds are most in evidence—again a large firm-jointed prickly-pear (*Opuntia* sp.) referred to on Fort George Island, and two fragile-jointed ones. All three are collectively and individually more numerous and more prolific than elsewhere within their geographic ranges, as far as we know them.

The large-jointed prickly-pear is erect and diffusely branched. The large, but thinnish joints are usually conspicuous on account of the large areolae with dark-colored spicules; they are either spineless or copiously armed. The flowers are usually numerous, often ten to eighteen springing from a joint. The fruits are also numerous, relatively small and reddish-purple. The two joe-

[2] Journal of The New York Botanical Garden **22**: 197. 1921. **23**: 128. 1922. **24**: 21. 1923.

FIGURE 1. In Salt River, a lagoon south of Crystal River, Fla. Here the several rocky reefs, small and large, that naturally came to about high tide level were transformed into kitchen middens by the Florida aborigines. After their occupation by the Indians the shell heaps were populated by vegetation started there through the agency of birds, for most of the plants are berry-bearing and favorite bird foods. The various shades of greenery contrasted with the bleached shells make enchanting pictures in the lagoon

jumpers just referred to—*Opuntia Tracyi* and *O. impedata*—are both luxuriant and prolific. Instead of a series of strings of joints or a single layer of joints on the ground, they are piled up three, four, five, and six layers deep with those of the bottom layers stout and more or less indurated. The species grow close together, often in contiguous colonies. They form an effective barrier to progress. The joints are copiously spiny, and the spines are loosely inserted in the joints, separable by the merest touch; so that one's clothing is not long in being covered with the young and old spines when collecting on the dunes.

The Halifax River region was our next objective. We traversed the Dixie Highway from Jacksonville to Ocean City which is near the northern extension of the Halifax River. The edges of the roadway, embankment, and parallel ditches were lined with two dominant plants, both of the thistle family, the one surely a native boneset (*Eupatorium capillifolium*), commonly known as dog-fennel, the other a showy bitter-weed (*Helenium tenuifolium*), perhaps an immigrant from the south-central United States. In the broad marshes the numerous wand-like stems of the colonies of the cowbane (*Oxypolis filiformis*) supported their white umbels above all the other herbaceous vegetation.

In the ponds and fresh-water lagoons the yet little understood large-leaved pond-lily often almost hid the surface of the water beneath the victoria-like floating leaves. In the higher pinelands southward the horse-mint (*Monarda punctata*) became more abundant, and showed greater variety in shades of color of its bracts and flowers than it did in the northeastern corner of the state.

At Ocean City we crossed over to the sand-dunes. There one of the first plants we found was the coontie (*Zamia umbrosa*), thus extending its geographic range several miles northward. The dunes were less floriferous than in the spring. The coastwise verbena (*Verbena maritima*), the Chapman-goldenrod (*Solidago Chapmanii*) and the iron-weed (*Vernonia altissima*) were in evidence, but these plants bloom there the year round. An additional yellow-flowered plant was a partridge-pea or wild-sensitive-plant (*Chamaecrista fasciculata*) which blooms mainly in spring and summer.

We continued southward to Mosquito Inlet. There *Heterotheca subaxillaris* lined the roadsides with yellow in place of the usual sneeze-weed mentioned above. At that season the lower parts of the Halifax River region yielded more interesting vegetation than the upper. One of the more striking phenomena in the landscape was the contrast along the line where the white saw-palmetto of the dunes met the brown rushes of the marshes. On the rolling dunes the saw-palmetto was in copious fruit. The great bunches of luscious fruit were very enticing. However, although they furnished the aborigines with an important food supply, they have never been relished by the white man.

The flat plain-like areas of the dunes, not infrequent between the rolling parts, supported miniature forests of the varnish-leaf (*Dodonaea jamaicensis*). Wherever we find this shrub, it seems to be in flower and in fruit at all times of the year. An accompanying shrub with a limited flowering season, known as -tia (*Sageretia minutiflora*), was then blooming. Its small flowers are very fragrant and the fragrance is quite distinctive.

The large shell-middens of the coastal dunes also yielded an ever-bloomer, an herb –scarlet-sage (*Salvia coccinea*). The shells were also well covered with a fine-stemmed chickweed (*Alsine Baldwinii*), with small starry white flowers. In this region the several species of prickly-pears are quite definitely localized. For example, the many-fruited opuntia may be found on the coastal sand-dunes, *Opuntia Dillenii* on the kitchen-middens, *Opuntia stricta* and *O. nitens* on the aboriginal village sites.

Aside from our cactus studies in the Mosquito Inlet region, the most important discovery was the occurrence of a heliotrope-relative (*Tournefortia poliochros*) growing on the kitchen-middens. This berry-bearing vine new to the flora of the United States, was heretofore not known nearer than Cuba and the Bahamas. Its fruits, the size of small peas, are white with purple-black spots and resemble little eyes. They are evidently attractive to birds, and the migratory kinds doubtless brought the seeds to the Florida shore from the West Indies. The continuous warmth of the kitchen-middens derived from heat stored in their porous structure, has enabled this plant to maintain an existence far north of its normal geographic range.

Our next move was from the eastern coast to the western. After reaching the old highway between De Land and De Leon

Springs, by traversing the northern extension of the southern Florida flat-woods, we selected an unusual route to Ocala. West of the coastal hammock belt there is much low .country. In this and the higher land the boneset genus *Eupatorium* was ubiquitous. The greenery of the cypress heads was striking. The more open places in the cypress heads supported forests of miniature trees of the shrubby St. John's-wort (*Hypericum fasciculatum*) covered with myriads of small yellow flowers. To break the monotony a plant of beggars'-ticks (*Coreopsis*) or of a sunflower-relative (*Helianthella*) stood out in the marshes along with hosts of pipewort (*Eriocaulon decangulare*) which suggested so many miniature flag-poles.

On the eastern edge of the lake region the land is higher. Here the old highway connects northern and southern points in that part of the state. Its older age is indicated by the rows of old live-oaks, laurel-oaks, Indian-cigar (*Catalpa*), and gum trees (*Eucalyptus*) planted on each side of the road many years ago. The oaks stand their age best. The Indian-cigar, a native of the southeastern States, like the tulip-tree (*Liriodendron*) is typically a tree of river-banks, ravines and moist woods, and when planted in drier situations begins to drop its leaves early in the summer, rapidly or slowly as the weather is dry or rainy.

When we turned in towards the Saint John's River near the southern end of Lake George, the characteristic plant-associations of the lake region became evident—scrub, black-jack ridges, alternating with high pineland. Several unusual areas appeared east of the Saint John's. The arboreous growth was a mixture of black-jack (*Quercus Catesbaei*) and the spruce-pine (*Pinus clausa*). Lakes soon appeared. Many of them had a bright-green fringe of spatter-dock (*Nymphaea*) with the monotony of the close-set leaves broken by its own yellow bonnets, and with stalks of maiden-cane (*Panicum hamaetonum*) and yellow-eyed grass (*Xyris ambigua*) projecting above the leathery lily pads. About the lakes were oak groves. Sometimes the growth was an almost pure association of black-jack (*Quercus Catesbaei*) or of the upland willow-oak (*Q. cinerea*).

In the lower grounds near the river we found copious thickets of guava (*Psidium*) trees. These had evidently been naturalized there for many years. When we reached the river we had

FIGURE 2. In Salt River, Fla. The most barren kitchen-midden of the Salt River group—in about the same condition as the aborigines left it. The prickly-pear, that favorite food-plant, is there. The insert shows a skull of a skeleton of one of the Florida aborigines, now extinct, just as it was unearthed. Two staple foods were prickly-pears and oysters. Kitchen middens were temporary places of residence. Village sites may or may not be found near them. Large middens or groups of small middens are accompanied by earth burial mounds. Burials were sometimes made directly in the shell heaps.

come to classic botanical ground. We crossed the river at or near the spot where William Bartram found the royal-palm (*Roystonea regia*) a century and a half ago.[3] At that time Florida, evidently, had had a more tempered climate for the royal-palm is now found naturally only at the southern end of the peninsula. Even these specimens are nowadays killed by "freezes." This species, in Florida, is actually being "pushed to the wall," for the geographic range ends naturally with the southern tip of the Florida mainland.

Our immediate objective on the western side of the Saint John's was Lake George, also classic botanical ground, for here on its shores William Bartram camped and collected plants in the later half of the eighteenth century. Inquiries as to the possibilities of getting over the trail to our objective resulted in conflicting information—positive and negative. In the end both were correct for the accomplishment depended on the power of the motor and the disposition of the driver. Once on the western side of the Saint John's we were not long in reaching the scrub which occupies an area nearly twenty-five miles wide west of Lake George. This scrub is a series of ancient sand-hills piled up, perhaps, when the land was less elevated and in place of the Saint John's River a great salt-water or brackish-water lagoon occupied part of its present watershed. Our primary objective and object of search in this scrub was the prickly pear recorded by William Bartram in the seventies of the eighteenth century. We drove down to the western shores of Lake George where Bartram records its occurrence. We could discover nothing in prickly-pears except the large tree-like plant we found there several years ago.[4] We found many large plants of *Opuntia ammophila,* the characteristic prickly-pear of the scrub. The specimens were particularly fine on the old Indian village sites and fields. The Indians doubtless used the fruits for food. Bartram's description has been a puzzle to subsequent generations. The writer, after studying the localities visited by Bartram a century and a half ago, has come to the conclusion that Bartram later in life, in writing of his former travels[5] in Florida, delivered

[3] Travels 113, 114. 1792.
[4] See Journal of The New York Botanical Garden **21**: 31. 1920.
[5] Travels 161. 1792.

his memory of a composite prickly-pear picture by combining the smoothish and large-fruited prickly-pear of the coastal Indian fields with the size and habit of the prickly-pear plant of the Lake George region.

The shore-region of Lake George was, evidently, a favorite place of residence of the aborigines. Their old fields about Silver Glen Spring are rich in broken pottery. These areas show several occupations, for in addition to the Indian pottery one finds broken china, and even more modern domestic objects. About these old fields the prickly-pears grew up to ten feet tall, but the more interesting plant was a tall bear-grass (*Yucca*) with white flowers only about one half the size of any of the recognized Eastern States' species of that genus.

The Natal-grass (*Tricholaena*) was not uncommon near the lake. It is being widely scattered over the Florida peninsula, mainly by its wind-transported fruits.

Our cactus studies being finished in the Lake George region, we set out over the giant rollers of white sand in the direction of the headquarters of Mr. Charles Rodgers, who is in charge of the Ocala Division of the Florida National Forest. A large part (35,000 acres) of the forest had been burned over early in the year. For mile after mile every tree and every shrub was destroyed. It was a dismal sight, and emphasized the fact that if burning continues in Florida the peninsula will revert to its infant condition—a desert. However, vegetation was not altogether wanting, for about two dozen herbaceous plants had sprung up out of the parched sands with added vigor furnished by the ashes from the forest fire and they were blooming profusely, especially the leguminous plants. The vines, butterfly-peas (*Bradburya* and *Clitoria*), and the milk-pea (*Galactia*), with flowers more numerous and larger than we had ever seen them, bedecked the dead shrubbery with myriad garlands. Plants with wand-like stems predominated, for example, the yellow-buttons (*Actinospermum*) were much in evidence. However, shades of purple were the dominant colors; especially prominent were members of the thistle family—elephant's-foot (*Elephantopus elatus*), deer's-tongue (*Trilisa odoratissima*), purple-torches (*Trilisa paniculata*), and blazing-star (*Lacinaria tenuifolia*). Yellow and rose-purple were conspicuous respectively

among the much-branched plants in the yellow foxgloves (*Afzelia*) and purple fox-glove (*Agalinis*).

In bogs and low level lands in the valleys between the sand-dunes, especially where the lumberman had formerly denuded the land, white flowers dominate—the white fringed-orchis (*Blephariglottis*) and the white marsh-pink were the plentiful plants. However, occasionally there would be acres of low lands so densely populated with foxglove (*Agalinis*) with purplish-green foliage, that the whole area would appear to be covered with a low purplish mist.

Juniper Creek, sometimes called Sweetwater Creek, which arises as Juniper Spring and flows into the southern part of Lake George, was prolific in aquatics. A dozen kinds were evident. Among these may be mentioned, for example, the erect shore plants, cat-tail (*Typha*), maiden cane (*Panicum haematomum*), jointed sedge (*Cyperus articulatus*), pickerel-weed (*Pontederia*), and poison-hemlock (*Cicuta*). The abundant floating plants were the eel-grass (*Vallisneria*) and the water-lettuce (*Pistia*).

As we crossed the old dunes, three of the old Indian foods were continuously in view—three palms whose berries the Indian once relished. They were the cabbage-tree (*Sabal Palmetto*), the scrub-palmetto (*Sabal Etonia*), and the saw-palmetto (*Serenoa repens*). We crossed the Ocklawaha River at dusk and entered the limesink region. After reaching Ocala we pushed on fifty miles northward to Gainesville, passing part way through the Middle Florida hammock belt, which we could identify even in the dark by the character of the roads.

In approaching Gainesville, we passed the Alachua prairie, a vast limesink which has been alternately wet and dry during the last century. William Bartram's description of it in the latter half of the eighteenth century is as follows:

"The extensive Alachua savanna is a level green plain, above fifteen miles over, fifty-miles in circumference, and scarcely a tree or bush of any kind to be seen on it. It is encircled with high, sloping hills, covered with waving forests and fragrant Orange groves, rising from an exuberantly fertile soil. The towering *Magnolia grandiflora* and transcendent Palm, stand conspicuous amongst them."

The same description applies today.

From Gainesville we took a southwestern course to Archer and Bronson. This region is the type locality for *Opuntia lata*, a species we discovered there several years ago. We were not long in locating many specimens of this long-fruited prickly-pear. Its club-shaped berries and red juvenile armament are quite different from any other of our eastern species of the group to which it belongs. Growing with the prickly-pear was a white-flowered bush-clover (*Petalostemon gracilis*), one of our rarer and rather inconspicuous species. On the other hand, in crossing the peninsula *Petalostemon carneus*, a related species and a very showy plant, was frequently seen.

The roadside weed there, in place of the bitter-weed of the eastern coast region, was a coffee-weed (*Cassia Tora*). According to the character of the soil, the plants of the colonies varied from six inches to six feet tall. On the black-jack ridges and the scrub between Archer and Bronson colonies of a blazing-star (*Laciniaria pauciflora*) appeared, often forming rose-purple patches on the white sand.

Having secured specimens of the prickly-pear of the lime-sink region, we headed southward from Archer and paralleled our course of the preceding night towards Dunnellon. Parts of this region had long been settled and cultivated, as evidenced by the tree-lined roads and by both cultivated and abandoned fields. Many of the latter were usurped by the amaranth-relative (*Froelichia*) with its cottony tops merged into a haze; others were white with the myriad flowers of the southern beard-tongue (*Penstemon multiflorus*), an elegant plant, both in foliage and in inflorescence. We drove through several heavy real "sun-showers," for the sun shone brightly while the rain poured down. Delays caused by stopping to let heavy thunder storms pass in front of us gave us opportunities to make small general collections of the plants of the region. The after-effects of rains frequent all over the peninsula made themselves felt when we got to the more southern and lower parts of the State.

JOHN K. SMALL.

(*To be continued.*)

FLOWERS FOR THE HOME GARDEN[1]

Before we discuss the flowers suitable to be used in the home garden, it is well to consider just what constitutes such a place. Any garden, be it large or small, that is in close proximity to the dwelling, that can be stepped into from the house, may be called correctly a home garden. Naturally, the majority of these will be fairly small, such as the usual suburban half-acre, or even less; but, a home garden may be two or even three acres in extent.

Several good rules should be followed in making such a garden. To be home-like, a garden must be enclosed, so a boundary of some sort must be there and preferably one that shuts the garden in, making it private. These boundaries may be simple or elaborate to suit the style of the garden, but, in any case, there will be an assortment of flowering and berry-bearing shrubs, a few evergreens, and ornamental trees. Among these latter, it should not be forgotten that a flowering tree that produces something for the kitchen is well worth while. Cherries, quinces, and Siberian crab-apples are as beautiful when blooming as any of their relations that produce little or nothing for the table. It is well to remember, too, that the plants in a garden can serve more than one purpose. Thus, they can screen the occupants of the garden from the public, satisfy the eye with their beauty and grace, and help to feed those valuable garden helpers we all should encourage, the birds.

The flowering plants to be used in the home garden may be divided into four main groups: bulbous plants, herbaceous plants, shrubs and trees, and creepers.

It is essential to use many bulbs. The majority of bulbous plants which are hardy in the vicinity of New York, bloom in the springtime, some of them very early, and they lengthen the flowering season materially. There are also a few autumn-flowering bulbs such as crocus and colchicum, that bloom as late as Thanksgiving. Among those that bloom in spring are many varieties of crocus, narcissus (daffodils), scillas (squills), muscari (grape hyacinths), hyacinths, and tulips. More unusual are the snowflakes, *Leucojum vernum* and *L. aestivum,* the quamashes

[1] Abstract of an illustrated lecture given in the Museum Building of The New York Botanical Garden on Saturday afternoon, September 19, 1925.

(*Camassia*), and the stars of Bethlehem (*Ornithogalum*). In the spring garden, combinations of these bulbs with rock plants such as the aubrietias, arabis, *Alyssum saxatile,* and dwarf irises, etc., etc., may be made near the edges of the flower borders.

In the home garden, plants of the same genus should never be planted in rows, in fact, if you let your garden give the effect of having been planted in rows, you will have failed. A group of several plants of the same sort, such as dahlias, will look well towards the back of the border and you can have groups at intervals, varying the varieties and colors if desired. Small bulbs should be grown in good-sized patches, as, indeed, should most bulbs. Tulips and daffodils look best in groups of not less than five.

It is far better to have only a few good sorts of plants in your garden than to fill it up with a heterogeneous accumulation of trash. There are plenty of fine things that are cheap, so the matter of expense need not discourage one who wishes a high standard of quality. If the garden is small the owner should restrain his desires for a large collection of many types of plants and choose for each season three or four genera. He should select from these several of the best varieties and have good masses of them. If he also plans so that he has bloom throughout the spring, summer, and autumn, he will have a very effective garden.

The flowery effect can be kept up by the introduction of annuals where the bulbs have died down, some of which may be sown in autumn, some in spring when the bulbs are uncovered and some transplanted from the frames. Very satisfactory perennials from which to select are irises, roses, phlox, delphiniums, columbines, campanulas, and hardy chrysanthemums. Among annuals, poppies, annual larkspur, corn-flowers, marigolds, clarkia, zinnias, and cosmos are good while other plants that are put in for the season only, such as dahlias and gladioli, cannot be dispensed with. Antirrhinums (snapdragons) should be treated as annuals and Canterbury Bells may be raised one summer, kept over winter in a frame to be set out in spring. The home gardener should save his own seed from any particularly fine variety as he will be sure then of having pink Canterbury Bells, if he prefers them to blue.

Where the garden is made in the country, natural advantages should be saved, especially if there are patches of ferns or wild flowers, groups of elders or other shrubs which are just as ornamental as foreign material. If the gardener desires this native material for a garden which lacks it, let him buy from the nurseries that specialize in these things; or if he helps himself let him bear in mind the preservation of wild flowers and take only a very little here and there. Many of our native plants are charming in the garden, particularly in a rock-garden.

Usually even a small garden will have several different exposures; a wise choice of material, judicious placing of it, with incessant and intelligent care, will produce flowers of a high quality for the home garden.

The lecture was illustrated by more than seventy colored lantern-slides, a majority of which were made in England by the late Reginald Malby.

ETHEL ANSON S. PECKHAM.

THE FRINGED GENTIAN

The time for harvesting Fringed Gentian seed is drawing near and I am still sending a small packet of the seed to any one who is interested enough to write for it.

I wish to emphasize the fact that there will be no flowers the first fall and the plants will be so small that they will be very difficult to find.

If planted according to the directions, which follow and which are sent with every packet of seed, the plants will produce flowers the *second* fall after sowing.

Directions:

Scatter the seed where the Fringed Gentian is to grow, in a thinly shaded spot or open field with *good drainage* and plenty of moisture, in a light loam.

The first year it will be very difficult to find the tiny plants but the second fall they will be from 8 to 12 inches high and in bloom.

This letter is one of many received this fall reporting success in propagating the Fringed Gentian.

"SEPTEMBER 27, 1925.

"MY DEAR DR. NORTON:

"I am among the fortunate people to whom you so kindly gave some Fringed Gentian seeds two years ago. You will be interested to know that I have three beautiful patches of gentians in bloom at present, two of them in two different low open places in the woods and one in an open field at the foot of a hill. They are a great source of joy and I wish to express to you my appreciation and gratitude.

"Sincerely yours,

"....."

I shall be very glad to receive a report, after the second year, from those who scatter the seed.

GEORGE F. NORTON,
320 East 176th Street,
New York City.

OCTOBER 16, 1925.

PUBLIC LECTURES DURING DECEMBER AND JANUARY

The following is the program of free lectures and demonstrations in the Central Display Greenhouse of Conservatory Range 2 on Saturday afternoons in December and January, beginning at three o'clock.

Dec. 5.	"Tropical Gardens,"	Mr. K. R. Boynton.
Dec. 12.	"Greenhouse Pests,"	Dr. F. J. Seaver.
Dec. 19.	"Air-plants,"	Dr. H. A. Gleason.
Jan. 9.	"Starch-bearing Plants,"	Dr. Marshall A. Howe.
Jan. 16.	"Variegated Plants,"	Dr. A. B. Stout.
Jan. 23.	"Cycads,"	Dr. John K. Small.
Jan. 30.	"House Plants and their Care,"	Mr. H. W. Becker.

NOTES, NEWS, AND COMMENT

Mr. E. J. Schreiner has recently made two trips into Maine and one into Canada for further studies in connection with investigations with poplars.

Professor H. H. Whetzel, of Cornell University, spent several days at the Garden in the latter part of October. On the 24th, he gave a very practical lecture in the Garden's Saturday afternoon course on "Keeping Plants in the Gardens and Borders Healthy."

Dr. Roland M. Harper, who was a student at the Garden during its earlier days, recently spent two weeks in this vicinity after an absence of four years. He is at the present time geographer of the Florida State Geological Survey and is engaged in studying the vegetation and other natural resources of southern Florida.

Dr. A. B. Stout, of the Garden Staff, spent a week during October in a trip to the State Agricultural Experiment Station at Geneva, N. Y., for the purpose of obtaining final results of the experimental work done in the requirements for pollination in various fruit crops—an investigation in which The New York Botanical Garden is coöperating with the Department of Horticulture of the Experiment Station.

Dr. H. A. Gleason spent the first week in November at the National Herbarium at Washington, studying certain plants of northern South America. While there he attended the meeting of the Botanical Society of Washington and on his return addressed the staff and graduate students of the department of medical zoölogy of Johns Hopkins Medical School on the cooperative botanical work now in progress on the flora of northern South America.

In September and October, the Park Department of the City resurfaced about a mile of the main roads within the grounds of The New York Botanical Garden, including the connections between the Bronx River Parkway and the Southern Boulevard, the Bronx River Parkway, and the Mosholu Parkway, and from the latter to near the 200th Street entrance. Concrete was used over the Telford foundation already in place, with an asphalt surfacing over the concrete. The last sections of this greatly improved road were opened to the public on October 14.

"Dahlia Day" at The New York Botanical Garden was observed on Wednesday afternoon, October 14, a later date than usual on account of the resurfacing of the Garden's driveways, which for a month made a near approach to the Dahlia Border by motor-cars impossible. A prolonged frigid gale, with temperatures of 33° to 39° F., on October 10, injured many of the plants, but some of the best new varieties, protected by the western windbreak of trees and shrubs, fortunately escaped serious damage. Up to the 10th, the general effectiveness of the display gradually increased. The plants were somewhat damaged by frost on the morning of the 28th and were finally killed on the morning of the 29th.

The New York Times of October 18 announces the recent dedication of a grove of Torrey pines (*Pinus Torreyana* Parry) on the bluffs overlooking the Pacific Ocean at the mouth of Soledad Cañon twenty-two miles north of San Diego as California's "birthday trees." They were discovered by Dr. C. C. Parry in 1850, the year of California's admission into the Union, and were named by him in honor of Professor John Torrey, the distinguished New York scientist, whose name is further commemorated by the Torrey Botanical Club. These peculiar pines were long supposed to be the only ones of the kind in existence but in 1888 another small grove was found on Santa Rosa Island, off the coast of southern California.

Meteorology for October. The total precipitation for the month was 4.66 inches, of which 0.02 inch fell as snow. The maximum temperatures recorded for each week were 68° on the 6th, *77° on the 17th,* 63.5° on the 25th and 61° on the 26th. The minimum temperatures were 33° on the 11th, 33° on the 14th, 33.5° on the 24th and *24° on the 31st.* The temperatures of 33° and 33.50°, noted above, damaged certain plants in some localities; but the first hard killing frost occurred on the morning of the 29th, when a temperature of 28° was recorded.

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THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York City

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THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

VOL. XXVI DECEMBER, 1925 No. 312

JOURNAL

OF

THE NEW YORK BOTANICAL GARDEN

GATHERING CACTI IN THE EASTERN COASTAL PLAIN—*Concluded*

JOHN K. SMALL

THE CULTIVATION OF WILD FLOWERS AND FERNS

HERBERT DURAND

SMALL GARDEN COMPETITION UNDER AUSPICES OF THE NEW YORK BOTANICAL GARDEN, 1926

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JOURNAL
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GATHERING CACTI IN THE EASTERN COASTAL PLAIN

(*Continued from page 258*)

On approaching Dunellon we had an opportunity to examine the "Indian mounds" of which we had had reports. Mere superficial examination showed them to be mounds of earth and rock piled up in the process of digging for phosphate rock.

In our cactus quest we eliminated Cedar Keys from our itinerary chiefly on account of the bad condition of the roads and lack of time. Fortunately, we had already gathered the prickly-pears of the shell-middens there and near the mouth of the Suwanee River and transplanted them in the cactus garden at Buena Vista. Our next natural objective was Crystal River, a region of great aboriginal activity centuries ago. Some of this ground was rather carefully investigated in the preceding spring.

We devoted our time in the Crystal River region to the kitchen-middens of Salt River. This water is a lagoon running southward into the labyrinth of channels toward Saint Martin's River. Salt River was an ideal place for occupation by the aborigines—perfectly protected waters filled with fish and oysters. They have left evidences of their occupation by eight large shell-middens in the river, four more at the haulover at Saint Martin's River, and small kitchen-middens on every point of land along the shores. These shell islands are very picturesque. The white piles of oyster shells and clam shells, with their greenery, stand conspicuously above the water and the surrounding lighter-green marshes.

These middens are relatively high but small in area and with

steep sides. Consequently there has not been much opportunity for the extensive growth of humus-forming vegetation. Their structure is almost pure shell material. Yet, considering their limited size, the vegetation is varied. Of course, at the water's edge are various salt-bushes, for example, groundsel-bush (*Baccharis*) and Christmas-berry (*Lycium carolinianum*). As indicated by the common name, the latter plant, on account of its bright red berries, is used for decorative purposes in parts where holly does not grow, and although a nightshade, the berries are used for making pies in season, and also canned for use at times when they can not be gathered fresh. About ten other kinds of shrubs were abundant, among them Spanish-bayonet (*Yucca aloifolia*), Florida-privet (*Forestiera porulosa*), and four vines, two representing temperate and two tropical types, or on the one hand poison-ivy (*Toxicodendron radicans*) and Virginia-creeper (*Parthenocissus quinquefolia*), on the other, snowberry (*Chiococca alba*) and milk-vine [*Amphistelma scoparia* (?)]. Four kinds of trees were in evidence—red cedar (*Sabina silicicola*), cabbage-tree (*Sabal Palmetto*), live-oak (*Quercus virginiana*), and hackberry (*Celtis georgiana*). However, more interesting was the finding of Dillenius' prickly-pear (*Opuntia Dillenii*) growing on the shell-middens just as it does on those directly opposite on the eastern coast.

In spite of the almost total lack of soil, as ordinarily understood, about a dozen kinds of herbaceous plants were observed on these middens. Some of these were prostrate in habit, as purslane (*Portulaca oleracea*) and spurge (*Chamaesyce* sp.?); others were erect, for example, sand-cyperus (*Cyperus brunneus*) and plumed-amaranth (*Iresine paniculata*). The two latter, together with the poor-man's patches (*Mentzelia floridana*) being tropical types, were of particular interest in connection with our studies of the vegetation of the Florida kitchen-middens. Another plant of particular interest to us was the cycad (*Zamia*), which we have thus far found on every kitchen-midden visited. Some results of our special studies on the representatives of this genus in Florida have already been published.[1]

In order to go further down the western coast, it was necessary to make a semi-circular detour many miles inland. We passed

[1] See Journal of The New York Botanical Garden **25**: 60 & 63. 1924.

through primeval country and through that cultivated by the white man for several generations with the natural vegetation destroyed or much modified. These observations lead us to reflect on some questions that will never be answered, to wit: What was the configuration and the vegetation of Florida in early geologic times and what was it like when man appeared on the scene? How much had it changed with the advent of and occupation by what we term the aborigines? How much did the old red-man modify it, just as the white-man is modifying it today?

This modifying and destroying process has progressed rapidly in many of the higher parts; it has been slower or nil in many of the lower parts. The animal life, likewise, has been and is being modified and destroyed. Even the bivalve is suffering reduction. The aborigines drew upon the oyster, for example, down to after the advent of the white man, as is evidenced by the kitchen-middens and the early Spanish records. Up to a generation ago oysters measuring up to ten and eleven inches were common along the coasts. Today in the same localities three and four inches are the maximum measurements as a result of the too generous drafts on the natural supply.

But to return to vegetation. Our course inland lay through seas of yellow partridge-pea (*Chamaecrista*), usually knee high, with frequent taller specimens of umbrella-plant (*Eriogonum*) and boneset (*Eupatorium*) interspersed. There a more delicate prairie-clover (*Petalostemon Feayi*) replaced *Petalostemon carneus* mentioned above. The heads of *P. Feayi* show more of violet and the fragrance is that of dog-fennel (*Eupatorium capillifolium*). Our route lay through Inverness and Brooksville and brought us back to the coast at Aripeka, or in the terms of plant geography, from the Gulf-hammock region through the lime-sink region to the Brooksville hammock-belt, and in reverse order back to the Gulf of Mexico. Unfortunately, lack of time prevented any special investigations in these plant regions. Especially unfortunate was our inability to provide for a look into the fern grottoes along the Withlacoochee River[2] at that season and at the great hammock north and south of Brooksville.

However, in passing through the Choocochattee hammock we collected the West Indian swamp bracken (*Blechnum occiden-*

[2] See Journal of The New York Botanical Garden **21:** 32–38. 1920.

FIGURE 3. On Merritt's Island, Fla.—The coquina southern tip of the island, which, although of soil, abounds in spinescent plants—prickly-pears, Spanish-bayonet, saw-palmetto, and hardwood trees and shrubs—all of which furnished provender for the early red man. Here, as elsewhere where a food-supply was abundant, we find kitchen-middens and burial mounds. This coquina-formation, like the kitchen-middens, absorbs much heat, which is radiated slowly. The vegetation, like that of the kitchen-middens, is largely tropical.

tale) at the only station known this side of the Gulf Stream, and associated with it we were surprised to discover the West Indian rein-orchis (*Habenaria Habenaria*), the type species of the genus *Habenaria,* which was collected in Florida only once before, many years ago. The flowers of this orchid are white and have a fragrance closely resembling that of the Japanese-honeysuckle (*Nintooa*). A third West Indian plant came to light here a virgin-bower (*Clematis dioica*). This vine resembles, in habit, our northern virgin-bower (*Clematis virginiana*) and our southern *C. Catesbyana,* but the flowers are much smaller than those of either species just mentioned. Considering the occurrence of these typical West Indian plants growing closely associated, the idea of the possibility of the occurrence of other West Indian plants both in this hammock and in the Annuttalagga hammock north of Brooksville was forced upon us.

Some of the floristics of the country between Brooksville and the Pinellas Peninsula have been described in a preceding article.[3]

At Clearwater we started on another inland detour around Tampa Bay. Although the bay was not visible, its proximity was indicated by the presence of much railroad-vine (*Ipomoea Pes-Caprae*) in the pinewoods. In the higher parts a wild sensitive plant—partridge-pea—appeared just as it did at the beginning of the detour mentioned above, but instead of a large-flowered kind, it was the small-flowered *Chamaecrista aspera* in this case. The showy plant on this detour was Garber's shooting-star (*Laciniaria Garberi*), which sometimes occurred in the low pinelands in large colonies or even by the acre. Having crossed the Manatee River we were soon back to the Gulf of Mexico. The higher ground was occupied by pineland and scrub, while swamps and marshes were extensive toward the water. The several mangroves came much in evidence on this tangent of our course. The coontie (*Zamia integrifolia*) reappeared here in the pinewoods, while the most abundant flowering plant in the wet pinelands and in marshes was the peculiar boneset (*Eupatorium mikanioides*)—so named from the shape of the leaf-blades which, in addition to their odd shape for the genus, stand edgewise instead of horizontal.

[3] Journal of The New York Botanical Garden **25**: 65 and 66. 1924.

As we reached Salt Springs, the sun set. Just east of the Springs we encountered a washed-out culvert. While debating as to whether to turn back or cross the washout some way, we found gigantic specimens of one of our rarer terrestrial orchids (*Triorchos ecristatus*). The plants growing in a pineland thicket were higher than one's head. We finally crossed the washout on two lines of narrow planks supported by a lot of discarded camp equipment, and started off across the peninsula toward Charlotte Harbor and Punta Gorda. We had now reached a part of the state which is decidedly lower in altitude than what we had already traversed. The result of the frequent rain storms was soon visible, for we entered a flooded country. Just after dark we bogged in the quicksand and mud. After three hours of digging and manoeuvering we released the car and proceeded toward our destination. A distance of ten miles through the water over a trail so obscure in the darkness that we could locate it only by walking ahead in the water in order to feel the ruts, brought us to higher ground. Thence we found our way to Punta Gorda. It was interesting and botanically unexplored territory we traversed, but how it looked and what plants were there remained conditions still to be learned.

Morning found us again picking our way through the mud on the eastern side of the Pease River en route to Fort Myers. The intervening low country was often well colored with flowers. An undescribed genus of the thistle family was the most conspicuous of the purples. In fact it is a purple in a class by itself and very striking. Related shades were furnished by meadow-beauties (*Rhexia*) and blazing-star (*Laciniaria*). The only conspicuous red flower was the leopard-lily (*Lilium Catesbaei*). Plants with white flowers and with yellow were about equally plentiful. Of the former a marsh-pink (*Sabbatia Elliottii*), the albino bluehearts (*Buchnera elongata*), and cowbane (*Oxypolis filiformis*) may be mentioned. The yellows were mainly of the goldenrod (*Solidago Chapmanii*), the yellow eyed grass (*Xyris*), and a goldenrod relative—rayless goldenrod (*Chondrophora nudata*). An occasional shrub of tar-flower or fly-catcher (*Befaria racemosa*) showed clusters of the starry flowers in the pinewoods.

Having reached Fort Myers more expeditiously than we had anticipated, judging from reports as to the condition of the road

and trails, we were encouraged to strike out for Caxambas without delay. Although the country was very wet and becoming more so day by day as a result of frequent showers, we made the first half of the distance with ease. Most of the way lies through high pineland, *i.e.*, high for that part of the country, and through scrub which is still more elevated. The pine woods adjacent to the road had a different look at this time of the year which was midway between our former excursions. The saw-palmetto (*Serenoa repens*) bore great clusters of luscious looking fruits,[4] instead of plumes of fragrant flowers. Composites alone were the conspicuous dicots—the slender purple blazing-star (*Laciniaria Chapmanii*), the yellow goldenrod (*Solidago angustifolia*), and the sordid-white boneset (*Eupatorium mikanioides*) already mentioned. In the scrub the very robust and densely flowered blazing-star (*Laciniaria elegans*) grew in patches of thousands, commonly supporting several of the club-like rose-purple flowering stems on a single tuber-like root. The other plant in bloom in the scrub was just the opposite in size, structure, and color a slender wire-weed (*Polygonella ciliata*) with slender wiry stems and small pale flowers. The ponds in the cypress-heads were filled with two plants of distinct families, but of much the same habit –a red-root or paint-root (*Gyrotheca tinctoria*) and false red-root (*Lophiola aurea*).

The second half of the road passed through a northern extension of the Ten Thousand Islands region. Our attention was required on the road, consequently little was accomplished in the way of botanical observations, except on the immediate roadsides. The exceptionally wet season had caused such a rank growth that the roadway, although used daily, had become almost obliterated. The following plants, in various sequences, had grown to twice their usual size or more: Bermuda-grass (*Capriola Dactylon*), panic-grass (*Panicum fuscum*), galingale (*Cyperus tetragonus*), balloon-vine (*Cardiospermum Halicacabum*), coffee-weed (*Cassia Tora*), railroad-vine (*Ipomoea Pes-Caprae*), dog-grass (*Eleusine indica*), Jerusalem-cherries (*Physalis angu-*

[4] The flavor of the fruits is disappointing. It has been recorded that they taste like "rotten cheese steeped in tobacco juice." See J. Dickenson's "God's Protecting Providence, Man's Surest Help and Defense. . . ." 1696.

lata and *P Elliottii*). In the marshes the rank growth of the various salt-bushes (*Baccharis*) almost blocked the road. The Cape Romano region was our objective.

We stopped at the settlement of Caxambas. The island of Caxambas is a collection of sand-dunes back of Cape Romano with a maximum elevation of eighty-seven feet. The plant covering is extremely interesting and has been partly described in several papers already published.[5]

Associated with the dunes are several kitchen-middens. In addition, a great variety of other flowering plants and cacti are a very prominent feature in the plant covering. (I) The dildoe (*Acanthocereus floridanus*); (II) the key prickly-pear (*Opuntia keyensis*), and (III) Dillenius' prickly-pear (*O. Dillenii*) often render the hammock impassable. The discovery of the dildoe and the key prickly-pear there fixes the known northern limit of their geographic ranges on the western coast. The open sandy slopes of the island are literally clothed with a prickly-pear of another group one which for the present must be referred to as the many-fruited prickly-pear mentioned above (*Opuntia* sp.). This discovery fixes, for the present, the southern limit of the range of that species. If the Caxambas plant is really the same as that from the northern end of the eastern coast, we have evidence of some weight that indicates that at a remote time in the past when the Florida peninsula was much higher there existed a more extensive and continuous cactus covering and that the species in the widely separated areas as we now find them are mere remnants.

.In the morning we crossed over to Cape Romano, by boat. There the list of prickly-pears found on nearby Caxambas was augmented by additional ones. There was (I) the striped-spined prickly-pear (*Opuntia zebrina*) whose northern limit was for-prickly-pear—doubtless a new species, but much more robust and with much larger spines than those of any of our yellow-spined species; and (III) the smallest prickly-pear of the region and related to the joe-jumpers, but wholly distinct from any of the known species. We have named it *Opuntia eburnispina* on account of its ivory-like clustered short spines. The dildoe (*Acanthocereus*) was in flower.

[5] Journal of The New York Botanical Garden **22**: 55–60. 1921. **24**: 221–224 1923.

On Cape Romano the sand and shell heaps were bright white. The flowers, in various colors, of the plants that grew there were conspicuously bright. The bright-blues of the blue curls (*Trichostema*) and the dew-flower (*Commelina*), bright-white of the swamp-root (*Phaethusa*), the bright-yellow of the wild-unction (*Urechites*), and the bright-orange of the flame-flower (*Talinum*) were striking. The wild-cucumber (*Melothria*) with stems several yards long formed a decorative lace-work on the white sand with its bright-green leaves, yellow flowers, and green-speckled fruits. The spurges were the most numerous kinds representing a single family. The fragrance was copiously supplied by the saffron-plum (*Bumelia angustifolia*) and the indigo-berry (*Randia aculeata*).

Caxambas was an ideal spot for aboriginal settlement and the early red man has left evidences of his occupation not only in the discarded shells of the oyster and clam, and particularly of the merly thought to be Cape Sable; (II) a relative of Dillenins' conch, but also in the vegetation, for the morning-glory with roots often as big as a bushel-basket—perhaps one of their food plants —which is found on shell-middens and evidently a relic of abo riginal agriculture, is more common there than on any of the middens we have so far visited.

After a few more hours' collecting on Caxambas Island, we started northward on our detour across the peninsula. To accomplish this by the shortest route then possible, or in other words to get to the eastern coast, we had to go north to Zolfo Springs by way of Fort Myers, Punta Gorda, and Arcadia. *En route,* there were banks of the copious-flowered wire-weed (*Polygonella brachystachya*) in the scrub, which resembled snow-drifts. This plant was so plentiful that its honey-like fragrance often filled the air. East of Zolfo Springs we entered the southern end of the lake region, which is unique from a physiographic and phytogeographic standpoint. We had never been able to investigate it in summer—only in winter and spring—and our dreams about the discovery of new plants there in the summer time were realized. For, the first showy plant then in flower we saw in the approaching darkness proved to be a new genus. In the vicinity of Sebring we made more extensive collections of flowering plants than elsewhere on that excursion. One of the interesting

observations was this: the vegetable covering of the great sand-hills evidently changes a number of times each year, for, let us say, of the two or three dozen kinds of herbaceous plants which are very plentiful on a given hillside in the spring, scarcely two or three of the same kinds are visible in the summer. Those of the spring time, having matured and scattered their seeds, die down and both plants (underground parts) and seed remain dormant until the following spring. And so with those plants characteristic of each season. The only way to get a complete idea of successive stages of the annual plant covering of this most unique region of the state would be to visit month to month the year around.

An examination of some of the sand-hills south of Sebring indicated that the summer flowering season was well past. However, a dozen or more herbs were plentifully scattered over the sands, usually in colonies or in patches. There was the pale-blue prairie-clover (*Petalostemon Feayi*) with finely lobed leaves, and the sky-blue lupine (*Lupinus diffusus*) with broad silvery leaves. The low yellow partridge-pea (*Chamaecrista*) was rather widely and evenly distributed. The two gregarious plants were tall and bore their inflorescences on wand-like stems—the elegant beard-tongue (*Penstemon multiflorus*) and the rather homely froelichia (*Froelichia floridana*).

We were fortunate in finding two kinds of hickories -forms of *Hicoria floridana*—in fruit. The dune or scrub hickories have been but little studied. This collection gives us a starting point for further study. In one kind the fruits are fig-shaped, that is, obovoid with a stipe-like base and the nut is ellipsoid; in the other the fruits are subglobose, without any constriction at the base, and the nuts are globose-ovoid. Before leaving the lake region we drove around the shore of Lake Jackson. The plant associations clothing the slopes of the lake basin represent (a) pineland, (b) hammock, and (c) scrub. Flowering plants were plentiful in the lake basin. In the pinewoods the fly-catcher (*Befaria racemosa*) with its white stars was the most conspicuous flower. There, too, especially in the high pineland, we were surprised to find a great deal of varnish-leaf (*Dodonaea jamaicensis*) which is usually a coastwise shrub. As usual, it was in both flower and fruit. The wet depressions in the lower pinelands were conspicuous on account of the masses of stiff stems of the

red-root (*Gyrotheca tinctoria*). It was in the hammocks that the showy flowers were found. Meadow-beauties (*Rhexia*) and gerardias (*Agalinis*) took precedence over the other plants for bright colors and abundance. The scrub was comparatively drab, except for the greenery. But, in reality, its flora and floristics, in special interest, eclipse those of the other associations. Beautiful plants of the new genus mentioned on a preceding page elevated their bright rose-purple heads in every direction. Most of the new and endemic species referred to in former articles were found.[6] The great majority of these are woody or partly woody plants and, of course, may be found at all seasons of the year, although not necessarily in flower or in fruit. Some woody plants, however, seem to flower and fruit all the year round in certain localities. Thus we found the tallow-wood (*Ximenia americana*) and the rosemary (*Ceratiola ericoides*) in flower as well as in fruit. There were two palms abundantly represented. There were two genera, in fact; but so much alike in habit that we had to be close enough to a specimen to see if it had an armed petiole and ribless leaf-blade—saw-palmetto (*Serenoa repens*)—or if it had a smooth petiole and a leaf-blade with a long midrib—scrub-palmetto (*Sabal Etonia*). The fruits of the saw-palmetto were of especial interest because they were not only exceptionally small, but nearly globular. The typical fruits are rather date-shaped. There were acres of Le Conte's galingale (*Cyperus Le Contei*) on the sandy shore of the lake. Through its numerous rootstocks and copious fibrous roots it served as an efficient sand-binder.

Heavy and continuous rains cut our work in the sand-hills short and at the same time stored up trouble for us toward the eastward. We left the sand-hills several miles east of Sebring, passed through some wet flat-woods, where the pine trees rose out of an unbroken and lively green sea of saw-palmetto, as far as the eye could reach, except where the snowy and honey-scented wire-weed referred to on a preceding page was conspicuously massed. When at last the prairies came within view they appeared like a bank of fog in the distance. About an average of a foot of rain water stood on the prairie. The trail was impassable in some places, so we had to take ourselves to the flooded prairie.

[6] Journal of The New York Botanical Garden **22**: 38 and 39. 1921.

FIGURE 4. Along St. Lucie Sound, Fla.—In hammock, now partly cleared, where the first settlement of white-men—colonists from such widely separated states as Georgia and New York—was established on the Indian River nearly a century ago. Here the celebrated Florida orange is said to have originated. The snake-cactus, a native of Mexico, shown above, was then introduced. It, like several other exotic cacti, established itself in the hammock, and has been growing there luxuriantly ever since.

With vegetation scarcely more than knee-high, an uninterrupted view of the complete circle of the horizon disclosed many local thunder storms which appeared on the horizon in place of the usual clouds of smoke from fires during the dry season. Purple was the color of the day—the dark purple of the storm cloud and the brilliant purple of the inflorescence of the new composite genus—*Litrisa*—mentioned on a preceding page. This firm succulent, with leaves somewhat resembling those of the colic-root (*Aletris*), is extensively stoloniferous and appeared in large colonies all over the prairie.

Incidentally, we may say that road-making, in Florida, is a *wonderful job*, but the results are often terrible! Before we had gotten very far from the edge of the pine woods, while in a foot and a half of water, the grass surface of the prairie failed us and the car settled in the mud up to the body—always a disheartening sight, especially near sundown. By roping and bagging the driving wheels we finally drove the car out of the slough without further bogging. After Istokpoga prairie came the Kissimmee prairies. The Kissimmee River was brim-full and the prairies too. The water was running over the causeway which connects the bridge at Fort Bassenger with the settlement of Bassenger on the eastern side of the river. Our approach to an old settlement was indicated by two plants very unusual in the wilds of Florida —Jimson-weed (*Datura Stramonium*) and bur-weed (*Acanthospermum hispidum*). These are both weeds of tropical origin. Whether they have persisted about Fort Bassenger since Seminole War times or are later introductions we will never know.

Okeechobee prairie was the next in order. Here, before darkness overtook us, we found acres of the new genus just mentioned and then pushed on to Okeechobee City, and reached Fort Pierce on the eastern coast in the night.

The next morning after some observations on the cacti—*Pereskia Pereskia, Hylocereus undatus, Selenicereus pteranthus, Acanthocereus floridanus, Harrisia fragrans, Opuntia Dillenii, O. ammophila*—of the hammock south of Fort Pierce, we stopped at Rio for specimens of Aaron's-beard (*Opuntia leucotrieha*) which, like three species mentioned at the beginning of the above list, were naturalized there from tropical America in the earlier part of the last century.

The various plant associations along the eastern coast had donned their summer regalia. The low grounds were the most floriferous. In them large patches of the rose-purple blazing-star (*Laciniaria elegans*), the bright yellow flaveria (*Flaveria linearis*), the blue (?) hibiscus (*Hibiscus furcellatus*), and gold-enrod (*Solidago Chapmanii*) succeeded one another many times. On the island dunes, conradina (*Conradina grandiflora*) with its speckled flowers was the plant of the season, while on the coastal dunes the beach sunflower (*Helianthus debilis*)—sometimes locally called black-eyed susan on account of its dark-centered and yellow-rayed heads—caught the eye more frequently than any other plant.

Our peregrinations from New York up to reaching Miami con sumed fifteen days. We had six days left for field work—four for the Miami region and two for the eastern coast between Miami and Jacksonville. Two days were consumed in sorting and packing specimens of cacti and in observation in the cactus plantation at Buena Vista.

In the Miami region we secured specimens of *Opuntia austrina.* The discovery and description of this species by the writer several years ago inaugurated the present era of cactus studies in the eastern Coastal Plain. The coastal dune prickly-pear heretofore considered a form of *O. austrina* has larger joints, longer spines, and larger flowers and fruits than those of the species with which it has been associated. Specimens were secured for further study.

On the day devoted to the Cape Sable region we drove as far as the Indian mounds near Mud Lake and to Flamingo on the Bay of Florida. There the individuals of three common cacti—*Opuntia Dillenii, Acanthocereus floridanus,* and *Harrisia Simpsonii*—are mostly epiphytic, chiefly because the hammock floors are too wet for long periods of the year for the plants to thrive in the usual terrestrial habitat, and decaying bark and wood of tree-trunks are plentiful and welcome harbors. Many plants of all these species "grow to great lengths" there. Stems of the *Harrisia* and the *Acanthocereus* twenty five to thirty feet long are not uncommon in the dense hammocks. We found new localities for some of the rare plants discovered in that region a year or so previous.

In passing, it may be of interest to note that the Cape Sable region is quite a palm center—a meeting place for palms charac-

teristic of the north and of the south. For example, in it the geographic ranges of the cabbage-tree (*Sabal*) and the saw-palmetto (*Serenoa*) are tapering off southward. Likewise the ranges of the saw-cabbage palm (*Paurotis*), the thatch-palm (*Thrinax*), the silver-palm (*Coccothrinax*) and the royal-palm (*Roystonea*) are tapering off northward. And so, facts of interest might be noted almost indefinitely.

Vines were a prominent feature in the Cape Sable region. Those then in flower were: milk-vine (*Philabertella clausa*), wild-allamanda (*Urechites lutea*), wild-rubber (*Rhabdadenia biflora*), snowberry (*Chiococca alba*), wild hemp-vine (*Mikania batatifolia*), morning-glories (*Ipomoea sagittata* and *I. cathartica*). The latter bore larger flowers with a shade of purple different from any we had seen elsewhere.

The most interesting herb, growing along with the mallow (*Kosteletzkya pentasperma*), which is not known elsewhere this side of the Gulf Stream, was a delicate Jerusalem-cherry (*Physalis*) with corollas only a quarter of an inch in diameter, with creamy edges and a yellow "eye."

Although the crest of the great wave of summer vegetation was past, there were numerous herbaceous plants flowering in the rocky pinewood of the Biscayne Pineland. Among the more conspicuous were four kinds of blazing-star—*Laciniaria elegans, L. tenuifolia, L. gracilis,* and *L. Chapmanii.*

The cactus observations during a day devoted to Cutler were confined to a natural plantation of seedling prickly-pears which had been under observation for several years, and which proved to represent *Opuntia austrina.*

Lack of time defeated our plans to spend a day on Big Pine Key. However, generous gatherings from that key and other Florida Keys installed from time to time in the cactus plantation at Buena Vista enabled us to complete the series of specimens for the exhibit of living specimens of the "Cacti of the Eastern Coastal Plain" at The New York Botanical Garden.

The white sands of the one-time coastal dunes—now building lots—opposite Miami still retained numbers of their native herbaceous vegetation in spite of various leveling processes. Some of the perennials are naturally adapted to maintain themselves under such circumstances. Of course, ordinary rootstocks and

roots often suffice, but there were two strikingly bright-colored plants in flower that have developed special methods for self-preservation. The one is an endemic milkwort (*Polygala cumulicola*), which has deep-seated stout coral-like roots, the other a 'ground-nut"—a four o'clock relative (*Okenia hypogaea*)—which bears two kinds of flowers, one very showy and barren, the other inconspicuous, subterranean, and fructiferous, and after anthesis buries its young fruits deep in the sand and there matures them. Now both these roots and fruits have much vitality, and when sand is moved—hills leveled and hollows filled—there are always sufficient roots and fruits left near enough to the surface to allow growth. We have observed this phenomenon for a period of about ten years. Both of these sand-lovers were in flower and the brightness of their rose-purple flowers was emphasized by contrast with the white sand.

On the way up the eastern coast, studies were made on prickly-pears wherever they were found, and living specimens of *Opuntia ammophila* were gathered at the type locality near Fort Pierce. Collections of and observations on other flowering plants were made as time permitted.

The ubiquitous beggar-ticks (*Corcopsis*) of the marshes and low pinelands was reinforced by an annual sunflower (*Helianthus floridanus*) with its numerous yellow heads. In the Jupiter and Hobe Sound regions the saw-palmetto (*Serenoa repens*) was loaded with luscious fruit. It was in this region that Jonathan Dickenson and his shipwrecked companions in the custody of the Indians had their first taste of the palmetto-berries in the year 1696.[7] In his account of their experiences along the Florida coast, he records that:

". . . Hunger has so far prevailed over them, that they could eat with an appetite the Palmetto-Berries; the Taste whereof was at once irksome, and ready to take away the breath."—Preface, page 46.

"In some Time after we had been in the house came in Indian Women, loaded with Baskets of Berries, mostly of the Palm, some seaside Coca-Plums, and Sea-side Grapes; Of the two latter we could eat, but of the Palm-Berries we could not bear the Taste in our Mouthes: . . ."—Page 46.

[7] God's Protecting Providence, Man's Surest Help and Defense, in Times of Greatest Difficulty and Most Imminent Danger. . . . Preface + 126 pages. 1696.

Scattered among the saw-palmetto were patches of the gopher-apple (*Geobalanus oblongifolius*). It was also in fruit, bearing white or pinkish date-shaped drupes. These are also edible and were doubtless used by the aborigines for food.

Acres of some of the dunes were covered with a naturalized plant, Natal-grass (*Tricholaena rosea*), which, as its specific name implies, formed seas of rose from which arose bright-green clumps of shrubbery—scrub-oaks (*Quercus*) and rosemary (*Ceratiola*). Fortunately, the oaks were in fruit and we were thus enabled to get additional material for our study of the scrub-oaks. On other dunes, flowerless plants made up the ground cover. Three lichens and one dwarf club-moss (*Selaginella funiformis*) predominated. The lichens that occur in quantity comprise three kinds of reindeer-moss (*Cladoniae*). In texture they are fine, medium, and coarse. Described in terms of color they range from white in the case of the fine kind to dark-gray in the coarse. The fine white kind grows in fluffy masses and often appears like great masses of white froth scattered over the sand. The finding of the sea-grape (*Coccolobis Uvifera*) on the top of the dunes was one of the unexpected incidents of the trip. By the discovery of the turkey-oak or black-jack (*Quercus Catesbaei*) near Jupiter, the known geographic range of this species is extended about seventy-five miles southward on the eastern coast. The lakelets among the ancient dunes were for the most part pond-lily (*Castalia*) gardens. In some of the latter the lilies covered merely the margins; in others the whole surface was a carpet of the deep green leaves spangled with white starry flowers.

In the coastal region of the mainland, at the lower end of the Indian River, there is a gradual change in the water-shed. Southward the tributary streams of the coastwise lagoons tend to flow to the south. Northward the main streams flow to the north, and that ancient lagoon, the Saint John's River, holds a northerly course for several hundred miles. There are extensive marshes and swamps on the divide where the drainage is uncertain. The dominant color of the flowers of these marshes seemed to be purple. In the winter the false deer-tongue (*Trilisa paniculata*) is in its prime. In the summer two plants dominate—rose-purple, the blazing-star (*Laciniaria elegans*) and a brilliant purple rela-

tive, *Litrisa carnosa,* mentioned on previous pages of this article. These plants grew so thickly placed in some parts of the flatwoods and marshes that their inflorescences, consisting of myriad heads, produced a purple haze close to the ground.

With the change of the direction of drainage there is a change in the floristics. One prominent tree in the hammocks about the divide of drainage is the loblolly bay (*Gordonia Lasianthus*), which is conspicuous on account of its rich-green leathery leaves and large camellia-like white flowers. Many of the hammocks of this region, like those further south, are being destroyed by fire. Although fire destroys the hammock, some trees seem to withstand its destructive effects. Those resistant to fire are for the most part the cabbage-tree (*Sabal Palmetto*), the live-oak (*Quercus virginiana*), the strangling-fig (*Ficus aurea*), and the mulberry (*Morus* sp.). The palm is hard to burn, the oak is well protected by its bark, and the fig and the mulberry have copious milky sap in the tissues near the surface. Of particular interest was the discovery of an apparently new plum (*Prunus*) on the old sand-dunes south of the mouth of the Sebastian River, a locality where several other new species had already been discovered. The exceptional floristics of the dunes and the kitchen-middens near the estuary of the Sebastian River will be described in the article to follow this.

The coquina-rock shore of the Indian River between Rockledge and Cocoa was lined with banks of yellow, the dominant plants being the goldenrod (*Solidago fistulosa*) and the flaveria (*Flaveria linearis*). Yellow was a very conspicuous color during the whole excursion, for mile after mile of roadsides in all parts of the state, except the southern part, were lined with two weeds, the bitter-weed (*Helenium tenuifolium*) and heterotheca (*Heterotheca subaxillaris*).

Reluctantly passing by the upper Indian River region and the Banana River we drove on to the Halifax River, where we found an additional station for the false-heliotrope (*Tournefortia poliochros*) mentioned in the earlier pages of this article. After making collections on kitchen-middens we continued northward, driving on the coastal dunes all the way to Ocean City. Two plants with blue flowers were the conspicuous herbs in the scrubby vegetation of the dunes; the one a fleshy spiderwort

(*Tradescantia reflexa*), the other a wiry twining vine, the butterfly-pea (*Bradburya virginica*). North of Ocean City we left the Dixie Highway and drove over the remains of the old King's Road to Saint Augustine. Four miles north of the southern present end of the King's Road we found zamia (*Zamia umbrosa*). This discovery added a little latitude to the northern limit of the geographic range of this species.

There is much high pineland and low pineland in this region, and also hammocks which border creeks. These hammocks are quite different from those of the coastal region southward. In these hammocks sweet-gums (*Liquidambar*), black-gums (*Nyssa*), water-oaks (*Quercus*), and many more characteristically northern woody plants predominate. In the swampy hammocks purple was again the dominant color. The southern nama (*Nama corymbosa*), with its deep-blue starry flowers, was scattered here and there in colonies. The southern leather-flower (*Viorna crispa*)- a peculiar form of it—bearing light-purple bell-shaped flowers and clusters of feather-tailed fruits, climbed over the bushes and even up into the trees.

At Pellicer's Creek, west of Matanzas, we unexpectedly found plenty of *Zamia umbrosa,* thus extending the known geographic range of this cycad a decided step northward. We hope to extend the range still further northward later on when we can explore the immediate region of the coastwise lagoons.

This itinerary, with special references to the cacti and other plants encountered, and incidental references to various side issues, will give some idea of what was accomplished during the three weeks' field work, in addition to bringing together and installing an almost complete series, as a public exhibit, of the cacti of the Eastern Coastal Plain in the conservatories of The New York Botanical Garden.

The results of our explorations for cacti in the eastern Coastal Plain may be epitomized in the final table appended to this article.

Two shorter tables precede the final one. The three tables will serve to show, in a graphic way, how little we knew of the cactus-flora of our Coastal Plain up into the second decade of this century and how rapidly the then undiscovered material was brought to light through the suggestions and coöperation of Charles Deering. Mr. Deering's former cactus plantation at Buena Vista,

Florida, served as a depository for the cacti as we brought them in from the field, and in the cactus plantation now in the Deering reservation at Cutler, Florida, all the specimens accumulated through the explorations in the Coastal Plain are growing. Most of the discoveries were made in time to be included in "The Cactaceae."[8]

THE CACTI OF THE EASTERN COASTAL PLAIN

As Known at the Beginning of This Century

(Stated in the nomenclature of today)

Hylocereus		floridanus	s. pen. Fla. & Keys
Acanthocereus		undatus	s. pen. Fla. & Keys
Harrisia		Simpsonii	s. pen. Fla. & Keys
Cephalocereus		keyensis	l. Fla. Keys
Opuntia	(*Curassavicae*)	Drummondii	N. C.–Fla
	(*Tortispinae*)	Opuntia	Mass.–Fla.
	(*Dillenianae*)	Dillenii	s. pen. Fla. & Keys

THE CACTI OF THE EASTERN COASTAL PLAIN

As Known in 1918

Hylocereus		undatus	s. pen. Fla. & Keys
Acanthocereus		floridanus	s. pen. Fla. & Keys
Harrisia		Simpsonii	s. pen. Fla. & Keys
Cephalocereus		keyensis	l. Fla. Keys
Opuntia	(*Curassavicae*)	Drummondii	N. C – n. Fla.
	(*Tortispinae*)	macrarthra	S. C. coast
		Opuntia	Mass.–Fla.
		Pollardi	S. C.–Fla.
		austrina	pen. Fla.
	(*Dillenianae*)	Dillenii	s. pen. Fla. & Keys
		?Bentonii	n. Fla.
Pereskia		Pereskia	s. pen. Fla.

[8] "The Cactaceae," by N. L. Britton and J. N. Rose. 1919–1923.

THE CACTI OF THE EASTERN COASTAL PLAIN

As Known Today

SELENICEREUS		CONIFLORUS	s. pen. Fla.—exot.
		PTERANTHUS	s. pen. Fla & Keys —exot.
HYLOCEREUS		UNDATUS	s. pen. Fla. & Keys —exot.
ACANTHOCEREUS		FLORIDANUS	s. pen. Fla. & Keys
HARRISIA		ABORIGINUM	w. coast Fla.
		SIMPSONII	s. pen. Fla. & Keys
		FRAGRANS	e. coast Fla.
CEPHALOCEREUS		DEERINGII	u. Fla. Keys
		KEYENSIS	l. Fla. Keys
OPUNTIA *Euopuntia*	(*Curassavicae*)	ABJECTA	l. Fla. Keys
		DRUMMONDII	N. C.– n. Fla.
		TRACYI	Ga.– n. Fla.– s. Miss.
		IMPEDATA	ne. Fla. coast
	(*Pisciformes*)	PISCIFORMIS	ne. Fla. coast
	(*Tunae*)	EBURNISPINA	Cape Romano, Fla.
	(*Ochrocentrae*)	OCHROCENTRA	Big Pine Key, Fla.
	(*Tortispinae*)	MACRARTHRA	S. C. coast
		OPUNTIA	Mass.–Ga.
		POLLARDI	Del.–Fla.–Ala.
		(undescribed sp.)	Cape Sable, Fla.
		LATA	n. Fla.
		TURGIDA	ne. Fla.
		(undescribed sp.)	ne. Fla. coast
		(undescribed sp.)	ne. Fla.
		AUSTRINA	pen. Fla.
		(undescribed sp.)	s. Fla. coast
	(*Ammophilae*)	AMMOPHILA	pen. Fla.
	(*Dillenianae*)	KEYENSIS	s. pen. Fla. & Keys
		STRICTA	Coastal Ga. & Fla. —Trop.
		DILLENII	pen. Fla. & Keys —Trop.
		LINDHEIMERI	s. pen. Fla.–Tex.
		?BENTONII	n. Fla.
		TUNOIDEA	S. C. coast–ne. Fla.
		CANTABRIGIENSIS	N. C. coast exot.
		MAGNIFICA	Amelia Id., Fla.
	(*Elatiores*)	ZEBRINA	s. pen. Fla. & Keys
	(*Ficus-indicae*)	FICUS-INDICA	pen. Fla.—exot.
	(*Leucotrichae*)	LEUCOTRICHA	s. pen. Fla.—exot.
Brasiliopuntia	(*Brasilienses*)	BRASILIENSIS	pen. Fla.—exot.
Consolea	(*Spinosissimae*)	(undescribed sp.)	pen. Fla.—exot.
PERESKIA		PERESKIA	s. pen. Fla.
RHIPSALIS		CASSUTHA	Big Pine Key, Fla.

JOHN K. SMALL.

THE CULTIVATION OF WILD FLOWERS AND FERNS[1]

I favor every activity by lovers of our wild flowers and ferns that helps to prevent their extermination. I particularly favor any measures that will impel old and young alike to show the same respect for the plants in Nature's garden that they accord to those blooming in the gardens of their friends and neighbors.

It is not enough, however, merely to try and protect, as best we can, what remains of our devastated flora; if we are to achieve successful preservation, we must increase and multiply what remains; restore and perpetuate what is lost. This can be done, in my opinion, only through cultivation under conditions that provide a friendly environment and encourage reproduction.

Such conditions exist only in our protected home grounds and gardens. Efforts to stop vandalism in fields and forests, even in public parks, have with rare exceptions proved futile. Large country estates, especially those with wooded areas, are ideal for sanctuary purposes; but congenial homes for many wildings can be provided on average-sized suburban lots.

Wild-flower cultivation requires intelligence, but this does not imply that the procedure is either complicated or difficult. It means that the simple but essential needs of the plants must be supplied. Woodland species must have shade, moisture, and leaf mold; the flowers of the field demand a sunny spot and soil closely akin to that in which they are found flourishing. So the would-be wild-flower gardener, to be entirely successful, must learn the habits and the habitat of his plants, that he may cater to the one and reproduce the other as closely as possible. The best way to learn is to go to the woods and fields during the growing season and acquire the desired information at first hand—a most delightful week-end or holiday pastime.

The cultural directions which follow will, it is hoped, stimulate interest in wild gardening and prove helpful to beginners and those who lack time and opportunity to study growth in the wild. Because of limited space, they are given as concisely as possible. The plants listed are fairly representative of our eastern flora and are confined to notably beautiful sorts that are easily grown and

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on October 3, 1925.

easily obtainable. By making suitable selections from among them, one can create a very attractive wild-flower garden that will occupy whatever space is available and display continuous and abundant bloom from April until November.

Planting and After-care

Most herbaceous plants should be set in the ground so the crown, or the junction of stem and roots, is not more than a half-inch below the surface. Certain ferns, however, which grow from large crowns, like the Christmas and Ostrich ferns, should be placed so that from one-half to two-thirds of the crown is above the surface. Bulbs of the Meadow Lily, the Turk's-Cap Lily, and the Trout Lily should be planted deeply—six to eight inches; while three to four inches is enough for Wood-Lily bulbs and for tubers of the Trilliums and the Spring Beauty. Maiden-hair and Beech ferns, and all plants with creeping surface roots, should be laid upon a bed of loose, woodsy earth, pressed in firmly, covered with a half-inch of the mold and mulched with two or three inches of dead leaves.

The mulch is most important. All new plantings should be kept covered with a light mulch until well rooted; and the entire wild garden should be given a heavy mulch of fallen leaves every winter. Lay twigs and branches over the leaves to prevent blowing away and do not remove them entirely until well along in the spring when all danger from hard freezing is over.

Unless the soil is moist, give newly set plants a thorough watering; and see to it that they do not lack water while becoming established and during dry weather thereafter.

Success Depends Chiefly upon the Soil

The most important difference between the cultivation of ordinary garden flowers and wild flowers lies in the character and treatment of the soil. Manure and commercial fertilizers, for instance, should never be used in the wild garden. Humus or leaf mold is the only fertilizer that is needed and the only kind that is tolerated by those rare and delicate species that are most admired and most likely to be exterminated by thoughtless picking or by transplanting.

Because of chemical variations in wild soils and their importance in the cultivation of wild plants, I have arranged my lists in

"soil" groups and specified the kind of soil with which all the plants of each group should be provided if they are to be successfully grown.

Species marked with a * can be obtained of most large dealers in hardy perennials. The others can be bought of dealers who specialize in native plants, or may, most of them, be collected from the woods and fields.

Group 1

Species which require soil of noticeable but not intense acidity. Example: the loose dark-colored forest mold found under deciduous trees. Avoid that under pines, hemlocks and other evergreens. For plants preferring a moist, sunny location, use one part of this woods humus to two parts of field or pasture top-soil. For those preferring a dry sunny spot, use equal parts of humus, top-soil, and sand.

(a) *Species preferring moist shade*

Canada Mayflower, *Maianthemum canadense.*
Wood Anemone, *Anemone quinquefolia.*
Partridge-berry, *Mitchella repens.*
Spinulose Shield-fern, *Aspidium spinulosum* var. *dilatatum.*

(b) *Species preferring dry shade*

* Wood Lily, *Lilium philadelphicum.*

(c) *Species preferring moist sun*

* Turk's-Cap Lily, *Lilium superbum.*
Meadow Beauty, *Rhexia virginica.*
Bluets or Quaker Ladies, *Houstonia caerulea.*
Royal Fern, *Osmunda regalis.*

(d) *Species preferring dry sun*

Star Grass, *Hypoxis hirsuta.*
* Wild Indigo, *Baptisia tinctoria.*
Bird-foot Violet, *Viola pedata* and var. *bicolor.*
Golden Aster, *Chrysopsis mariana.*
Double-bristled Aster, *Aster linariifolius.*

Group 2

Species which will not thrive in noticeably acid soil or in soil that contains much lime. Mix two parts of good garden loam

that has been manured, but not for two or three seasons, with an equal quantity of woods humus and the mixture will be about right. Avoid humus from under oaks as well as that from under evergreens. For sun-loving plants add one part sand.

(a) *Species preferring moist shade*

* Large White Trillium, *Trillium grandiflorum.*
Trout Lily, *Erythronium americanum.*
Spring Beauty, *Claytonia virginica.*
* Liverwort, *Hepatica triloba.*
Dutchman's Breeches, *Dicentra Cucullaria.*
Toothwort, *Dentaria diphylla.*
Bishop's Cap, *Mitella diphylla.*
Sweet White Violet, *Viola blanda.*
Canada Violet, *Viola canadensis.*
* Shooting Star, *Dodecatheon Meadia.*
* Virginia Cowslip, *Mertensia virginica.*
Maidenhair Fern, *Adiantum pedatum.*
Fragile Bladder-fern, *Cystopteris fragilis.*
Ostrich Fern, *Onoclea Struthiopteris.*

(b) *Species preferring dry shade*

* Columbine, *Aquilegia canadensis.*
* Wild Blue Phlox, *Phlox divaricata*
* Greek Valerian, *Polemonium reptans.*
* Harebell, *Campanula rotundifolia.*

(c) *Species preferring moist sun*

* Meadow Lily, *Lilium canadense.*
* Closed Gentian, *Gentiana Andrewsi.*
* Great Lobelia, *Lobelia syphilitica.*
Golden Ragwort, *Senecio aureus.*
Grass of Parnassus, *Parnassia caroliniana.*

(d) *Species preferring dry sun*

Wild Pink, *Silene pennsylvanica.*

GROUP 3

Species which are indifferent as regards soil acidity but fastidious as to texture, moisture, and exposure. Those preferring

shade, either moist or dry, should have a soil mixture of good compost, or woods humus, and either garden or pasture top-soil, equal parts of each. This mixture will serve also for kinds preferring a moist, sunny location, but sand should be added for those preferring dry sun.

(a) *Species preferring moist shade*

Solomon's Plume, *Smilacina racemosa.*
* Red Baneberry, *Actaea rubra.*
Bloodroot, *Sanguinaria canadensis.*
Foam Flower, *Tiarella cordifolia.*
Wild Geranium, *Geranium maculatum.*
* White Snakeroot, *Eupatorium urticaefolium.*

(b) *Species preferring dry shade*

* Crested Iris, *Iris cristata.*
Tall Yellow Violet, *Viola pubescens.*
Christmas Fern, *Polystichum acrostichoides.*
Evergreen Wood-fern, *Aspidium marginale.*

(c) *Species preferring moist sun*

* Larger Blue Flag, *Iris versicolor.*
* Cardinal Flower, *Lobelia cardinalis.*
New York Aster, *Aster Novi-Belgii.*
* Sneezeweed, *Helenium autumnale.*
Lady Fern, *Asplenium Filix-foemina.*
Interrupted Fern, *Osmunda Claytoniana.*

(d) *Species preferring dry sun*

* Wild Lupine, *Lupinus perennis.*
* Sundrops, *Oenothera fruticosa.*
* Butterfly Weed, *Asclepias tuberosa.*
Black-eyed Susan, *Rudbeckia hirta.*
Various Golden-rods, *Solidago* spps. Select for form and color.
Various Asters, *Aster* spps. Select for form and color.

HERBERT DURAND.

BRONXVILLE, N. Y.

SMALL GARDEN COMPETITION UNDER AUSPICES OF THE NEW YORK BOTANICAL GARDEN, 1926

A. *Purpose.*—The keynote of this competition is to popularize possibilities in the treatment of small (one man or woman) gardens with a maximum of taste and a minimum of expense. This must be kept constantly in mind by all competitors.

B. *Open Competition.*—The competition is open to all persons, professional or amateur, other than landscape architects and employees or members of staff of The New York Botanical Garden.

Copies of this program may be obtained at The New York Botanical Garden or will be mailed on request.

C. *Prizes.*—The first prize is $100 cash. The New York Botanical Garden also undertakes, during the Spring or early Summer of 1926, to lay out and plant, in a prominent location in its grounds, a garden on the lines of the winning design, and maintain the same as a public exhibition prize garden for at least one year.

The winner of the second prize will receive $75 cash.

The winner of the third prize will receive $25 cash.

D. *Publicity.* Wide publicity will be given to this competition; the names of the winners will be published and due credit for the authorship of the winning plan will be accorded on any public notice which may be posted in or on the prize garden referred to in the preceding paragraph.

E. *Jury of Award.*—The jury will consist of three distinguished garden experts—one nominated by The Garden Club of America, one nominated by The Federated Garden Clubs of New York State, and one by The New York Botanical Garden.

F. *Conditions.*—(1) The plot to be covered is 40 x 52 feet. These dimensions must be strictly observed. All plans must be scaled ¼ inch to the foot.

(2) No competitor may submit more than one plan.

(3) Plans shall be rendered in ink on mounted drawing paper, size of sheet 13″ x 18″ Color may be indicated but no perspective, picture, or photograph will be considered. If, however, a fence, pergola, or other construction is contemplated and can not be easily described, a simple sketch sufficient to indicate the idea may be submitted.

(4) Every plant, shrub, etc., must be given a key number and its position clearly located on the plan.

(5) The character of all material employed must be plainly indicated on the plan, which may also describe any special purpose which the garden is intended to serve, such as "Front Yard," "Back Yard," or "Suburban Garden."

(6) Each plan must be accompanied by a legible specification of all plants or shrubs employed, detailing the color, quantity, and the key number thereof. No expensive plants or shrubs are to be used. Annuals are permissible, but hardy perennials are preferred. Regard must be had for maintaining a succession of bloom for Spring, Summer, and Autumn, with harmonious color as the keynote and with due consideration of climatal conditions. A fence, pergola, brick or stone path, or any other appropriate accessory may be indicated; but no construction work is to be suggested which renders highly skilled labor imperative. In considering cost, the jury will assume that all plants are to be developed from cuttings, roots, divisions, bulbs, or seeds to minimize expense.

(7) The winning plans (1st, 2nd, and 3rd prizes) shall be the sole and exclusive property of The New York Botanical Garden, which shall own the copyright, photograph rights, and every other right and title connected therewith.

If full postage be included for that purpose, unsuccessful plans will be returned. But all plans submitted are wholly at the senders' risk and The New York Botanical Garden assumes no responsibility therefor.

G. *Submission of Plans.*—I. Plans must be submitted on or before 12 o'clock (noon) of the first day of March, 1926. No plan received after that day and hour will be considered.

II. Plans must be addressed to

Prize Garden Competition,
The New York Botanical Garden,
Bronx Park, New York City.

The wrapper must have no name or symbol identifying the sender.

III. Each plan must be forwarded flat (not rolled or folded). To it there must be firmly attached a plain, sealed, opaque en-

velope containing the name and address of the sender. No identification mark of any kind must appear on the envelope, plan or specification. Disregard of this requirement will absolutely disqualify the sender. Each envelope and plan will be marked as received for identification by the Committee but no envelope will be opened until the jury shall have rendered its decision.

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter, displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A **library** of botanical literature, comprising more than 34,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical scientific, and partly of popular, interest.

The **education** of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY